SIGNAL

July 1958

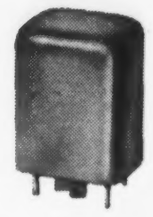
RECEIVED
JUL 15 1958

A Word of Greeting and Congratulations
to
the U. S. Army Signal Corps
on its
50th Anniversary
from
the people of

MINIATURIZED TRANSFORMER COMPONENTS FROM STOCK

Items below and 650 others in our catalog A.

HERMETIC SUB-MINIATURE AUDIO UNITS



These are the smallest hermetic audios made.

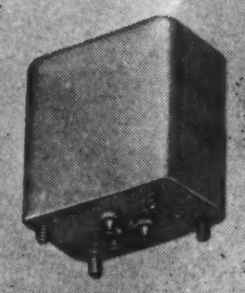
Dimensions . . . 1/2 x 11/16 x 29/32 . . . Weight .8 oz.

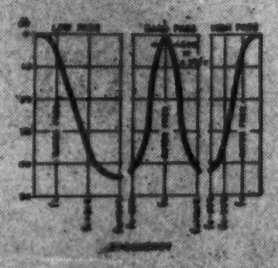
TYPICAL ITEMS

Type No.	Application	MIL Type	Pri. Imp. Ohms	Sec. Imp. Ohms	DC in Pri MA	Response ±2 db (Cyc.)	Max. level dbm
H-30	Input to grid	TF1A10YY	50*	62,500	0	150-10,000	+13
H-31	Single plate to single grid, 3:1	TF1A15YY	10,000	90,000	0	300-10,000	+13
H-32	Single plate to line	TF1A13YY	10,000*	200	3	300-10,000	+13
H-33	Single plate to low impedance	TF1A13YY	30,000	50	1	300-10,000	+15
H-34	Single plate to low impedance	TF1A13YY	100,000	60	.5	300-10,000	+ 6
H-35	Reactor	TF1A20YY	100 Henries-0 DC, 50 Henries-1 Ma. DC, 4,400 ohms.				
H-36	Transistor Interstage	TF1A15YY	25,000	1,000	.5	300-10,000	+10

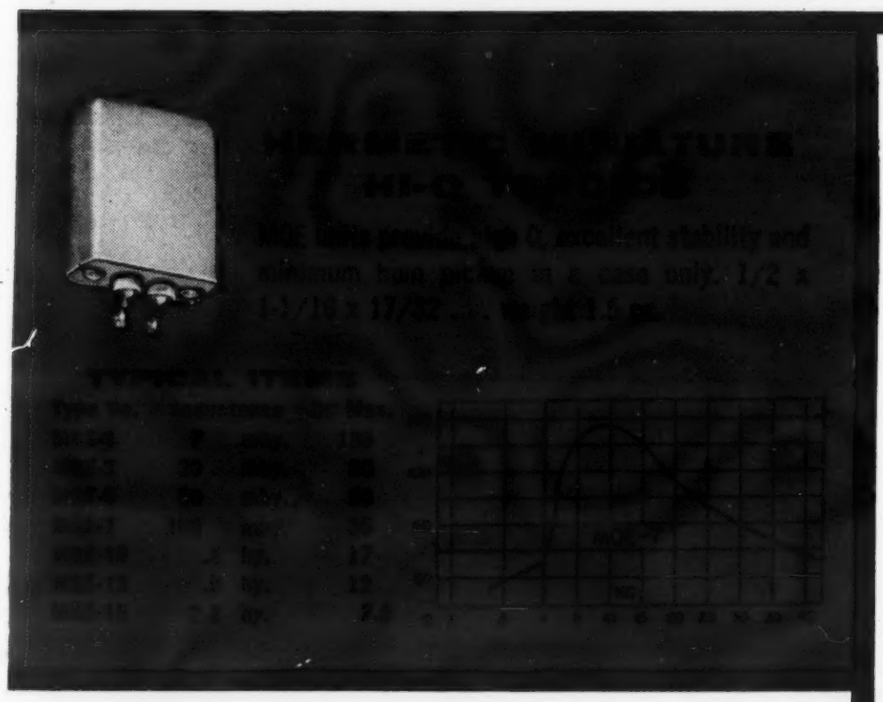
*Can be used with higher source impedances, with corresponding reduction in frequency range and current

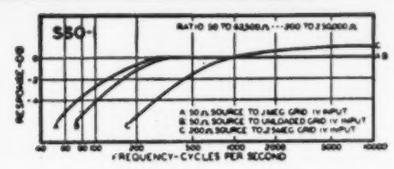
COMPACT HERMETIC AUDIO FILTERS

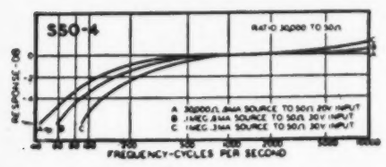




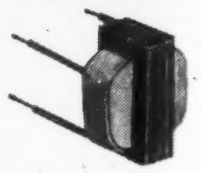
UTC standardized filters are for low pass, high pass, and band pass application in both interstage and line impedance designs. Thirty four stock values, others to order. Case 1-3/16 x 1-11/16 x 1-5/8 — 2-1/2 high . . . Weight 6-9 oz.







SUB-SUBOUNCER AUDIO UNITS



UTC Subouncer and sub-subouncer units provide exceptional efficiency and frequency range in miniature size. Constructional details assure maximum reliability. SSO units are 7/16 x 3/4 x 43/64 . . . Weight 1/50 lb.

Type	Application	Level	Pri. Imp.	MA D.C. in Pri.	Sec. Imp.	Pri. Res.	Sec. Res.
*SSO-1	Input	+ 4 V.U.	200 50	0	250,000 62,500	13.5	3700
SSO-2	Interstage /3:1	+ 4 V.U.	10,000	0-.25	90,000	750	3250
*SSO-3	Plate to Line	+20 V.U.	10,000 25,000	3 1.5	200 500	2600	35
SSO-4	Output	+20 V.U.	30,000	1.0	50	2875	4.6
SSO-5	Reactor 50 HY at 1 mil. D.C. 4400 ohms D.C. Res.						
SSO-6	Output	+20 V.U.	100,000	.5	60	4700	3.3
*SSO-7	Transistor Interstage	+10 V.U.	20,000 30,000	.5 .5	800 1,200	850	125

* Impedance ratio is fixed, 1250:1 for SSO-1, 1:50 for SSO-3.
Any impedance between the values shown may be employed.

OUNCER (WIDE RANGE) AUDIO UNITS

Standard for the industry for 15 yrs., these units provide 30-20,000 cycle response in a case 7/8 dia. x 1-3/16 high. Weight 1 oz.

TYPICAL ITEMS

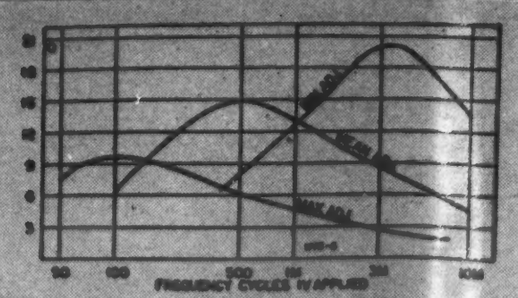
Type No.	Application	Pri. Imp	Sec. Imp
O-1	Mike, pickup or line to 1 grid	50, 200/250, 500/600	50,000
O-4	Single plate to 1 grid	15,000	60,000
O-7	Single plate to 2 grids, D.C. in Pri.	15,000	95,000
O-9	Single plate to line, D.C. in Pri.	15,000	50, 200/250, 500/600
O-10	Push pull plates to line	30,000 ohms plate to plate	50, 200/250, 500/600
O-12	Mixing and matching	50, 200/250	50, 200/250, 500/600
O-13	Reactor, 300 Hys.—no D.C.; 50 Hys.—3 MA. D.C., 6000 ohms		

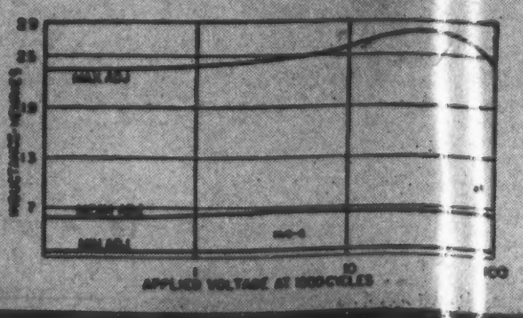
HERMETIC VARIABLE INDUCTORS

These inductors provide high Q from 50 - 10,000 cycles with exceptional stability. Wide inductance range (10 - 1) in an extremely compact case 25/32 x 1-1/8 x 1-3/16 . . . Weight 2 oz.

TYPICAL ITEMS

TYPE No.	Min. Hys.	Mean Hys.	Max. Hys.	DC Ma
HVC-1	.002	.006	.02	100
HVC-3	.011	.040	.11	40
HVC-5	.07	.25	.7	20
HVC-6	.2	.6	2	15
HVC-10	7.0	25	70	3.5
HVC-12	50	150	500	1.5





LET US MINIATURIZE YOUR GEAR.

SEND DETAILS OF YOUR NEEDS for SIZES and PRICES

UNITED TRANSFORMER CO.

150 Varick Street, New York 13, N. Y. • EXPORT DIVISION: 13 E. 40th St., New York 16, N. Y.

CABLES: "ARLAB"

RCA Weathervision sends the weather briefer to every flight point at the same time!

Heart of the Weathervision system is the console. From this "weather central," televised information is "piped" to receivers in briefing rooms strategically spotted around the base.

RCA Weathervision is closed circuit television, designed to provide accurate, up-to-the-minute forecasts to pilots and other base personnel concerned with flight conditions. It saves time and manpower, provides additional hours for the weathercaster to study conditions and prepare his briefings. With RCA Weathervision only one forecaster is needed to brief all locations simultaneously. Flying and administrative personnel can consult with forecaster at all times. All voice transmissions are taped for future reference.

RCA WEATHERVISION...A COMPLETE PACKAGE FOR WEATHER BRIEFING

The RCA system consists of the console, or originating location; the distribution system; and the receiving system. RCA can supply the complete package, providing all equipment plus installation supervision and nation-wide service where needed—assuring maximum convenience, dependable performance.

Console—The Weathervision console contains a TV camera focused on a data table on which are weather charts, other data. Viewing monitor above table shows picture seen at receiving locations. Microphone, speaker and amplifiers provide for communication between weathercaster, receiving personnel.

Zoom Lens—An innovation in weathercasting, providing continuous coverage of display area as focal length of lens is varied. Permits uninterrupted viewing, eliminates blackouts caused by turret turning. Provides smooth transition from wide angle to close-up views.

Ease of Operation—Only one adjustment—light level control—required at beginning of briefing. During briefing, only the zoom lens control is operated.

Receiving Locations—High quality TV monitors or receivers are used. Facilities allow pilot and administrative personnel to ask questions, receive answers.

Complete brochure on RCA Weathervision will be mailed on request. Write to RCA, Dept. H-291, Building 15-1, Camden, N.J. In Canada: RCA VICTOR Company Ltd., Montreal.

Tmk (s)®

RADIO CORPORATION of AMERICA

BROADCAST AND TELEVISION EQUIPMENT

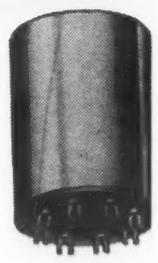
CAMDEN, N.J.

HI

These c
Dir

Type No.	Ap
H-30	Input t
H-31	Single grid, 3
H-32	Single
H-33	Single impeda
H-34	Single impeda
H-35	Reacto
H-36	Transis

*Can be used wit



Type No.	Ap
0-1	Mike, 1 grid
0-4	Single
0-7	Single D.C. in
0-9	Single in Pri.
0-10	Push
0-12	Mixin
0-13	React

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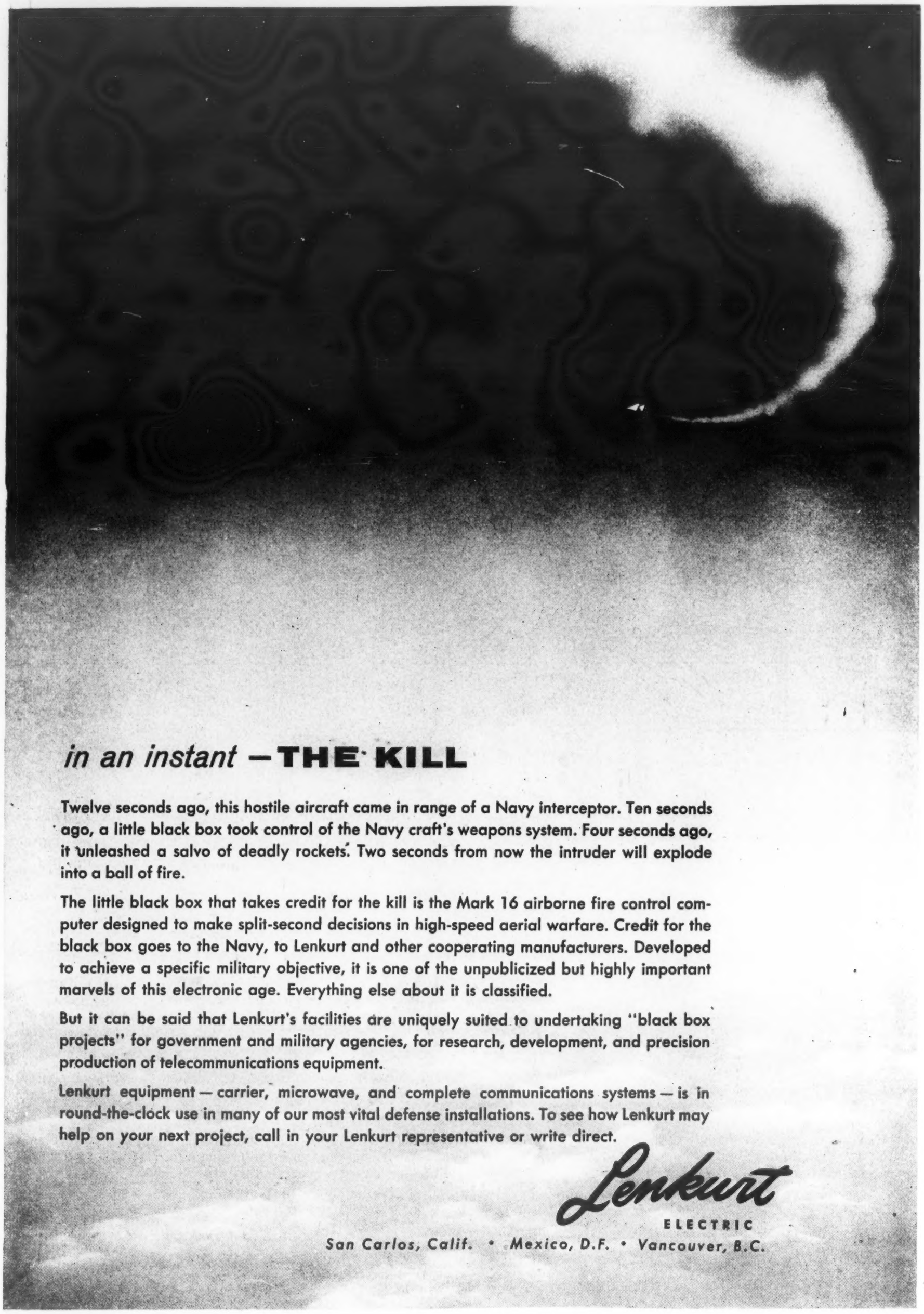
SEND DET


in an instant — THE KILL
Twelve seconds ago, this hostile aircraft came in range of a Navy interceptor. Ten seconds ago, a little black box took control of the Navy craft's weapons system. Four seconds ago, it unleashed a salvo of deadly rockets. Two seconds from now the intruder will explode into a ball of fire.
The little black box that takes credit for the kill is the Mark 16 airborne fire control computer designed to make split-second decisions in high-speed aerial warfare. Credit for the black box goes to the Navy, to Lenkurt and other cooperating manufacturers. Developed to achieve a specific military objective, it is one of the unpublicized but highly important marvels of this electronic age. Everything else about it is classified.
But it can be said that Lenkurt's facilities are uniquely suited to undertaking "black box projects" for government and military agencies, for research, development, and precision production of telecommunications equipment.
Lenkurt equipment — carrier, microwave, and complete communications systems — is in round-the-clock use in many of our most vital defense installations. To see how Lenkurt may help on your next project, call in your Lenkurt representative or write direct.
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BPA

SIGNAL

Communications-Electronics-Photography

Journal of the Armed Forces Communications and Electronics Association

VOLUME XII JULY 1958 NUMBER 11

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→ ***The August issue will carry the Convention Report*** ←

COVER

The cover photo by Collins Radio Company pictures the installation of a TST-101 Ground-Transportable Transhorizon (Scatter) Terminal. Air as well as surface movement of complete Transhorizon, HF single sideband and microwave communication terminals is achieved with Collins' complete line of Transportable Communication Systems. The cover photo was made during a U. S. Army Signal Corps test near Fort Huachuca, Ariz. *See story, page 14.*

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Authors are entirely responsible for opinions expressed in articles appearing in AFCEA publications, and these opinions are not to be construed as official or reflecting the views of the Armed Forces Communications and Electronics Association.

**A Stockpile article.*

SAGE SETS AN ELECTRONIC "BEAR TRAP"

BURROUGHS ELECTRONIC DATA PROCESSING EQUIPMENT STANDS WATCH FOR OUR CONTINENTAL AIR DEFENSE.

Problems of the awesome speeds and scope that confront our military defense systems can only be solved by the quick and uncanny accuracies of electronic computation, such as is found in our Semi-Automatic Ground Environment—SAGE, which is now becoming operational! As a result Burroughs radar data processing equipment fills important posts all along our peripheral continental approaches.

This major U. S. Air Force contract is one example of the widespread confidence in Burroughs Corporation's 70-year background of reliability and capability. It demonstrates Burroughs' new breadth in the development of electronic equipment and its continuing competence from research to final installation.

Burroughs Corporation

"NEW DIMENSIONS / in electronics and data processing systems"

A NATIONWIDE TRIBUTE

by Alex Dreier

to the armed forces communications/electronics field

FROM SMOKE SIGNALS TO satellites, the story of man and communications is replete with testimony that the best is never quite good enough. It's a hard philosophy, but one that has paid off in earth satellites, ballistic missiles and a technology that is advancing with amazing speed. Such speed, that the harried social scientist now wonders where man—and not the things he creates—will fit into the constantly changing present, and the relentlessly approaching future.

But man will find his place, of course. He always has. And when that brave new world of tomorrow arrives . . . with its global live color television hookups that bring the remotest areas of the world face to face with each other . . . when travel bureaus begin bemoaning the fact that they are all booked up for week-end excursions to the moon . . . and when extra-terrestrial labor organizations begin negotiations for three months' vacation *away* from Mars, the experts in Armed Forces communications, electronics and photography will be working on something new. They, themselves, don't know yet what it will be. But you may rest assured that it will be so radical—like Persian King Cyrus' regularly scheduled postal service, 500 years before the birth of Christ—that many will say it simply can't be done.

That negative nugget has been one of the guiding inspirations to the Armed Forces research men: the kind of challenge inventive men sometimes require. And the pages of history are heavy with the names of impossible-sounding gimmicks that were not only impractical in their day, but virtually impossible. Who ever heard of talking and having your voice carried for miles over a tiny wire? Who could conceive of someone standing in a sound-proof room in New York and being seen and heard by millions in Los Angeles? How could sounds and sights ever be transmitted across great expanses of land and water?

Well, it is axiomatic that each generation must produce its doers and its can't-be-doners. And each serves his purpose.

Yesterday the walkie-talkie was a phenomenon. Today, radio signals from the Explorer satellite are as much taken for granted as the morning toast . . . and much more expertly monitored!

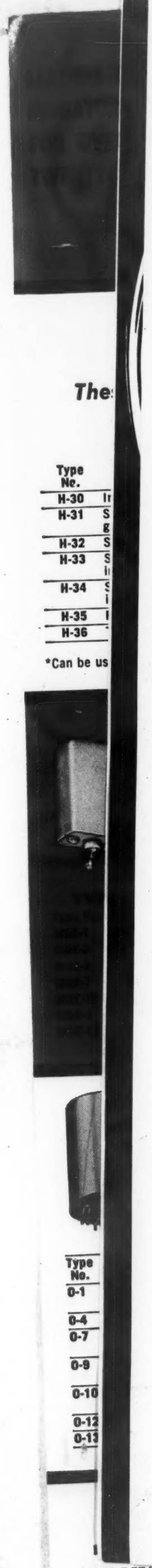
It is sad, but none-the-less true, that each great human conflict in which we have been engaged has produced great scientific and technological advances. During the Civil War, field commanders depended heavily on the bugle as a means of relaying commands on the battlefield. More recent wars proved the efficiency of radar, which could see the unseeable. And today pilotless aircraft carry their own eyes, while television has made it possible for tomorrow's general to watch the battle progress and plot his next moves.

Man marches ever forward. Whether to his own destruction or salvation, not even he can hazard a guess. He only knows that he must go forward or perish. And going forward is the business of the civilian and military experts in the highly complicated fields of communications and electronics and photography. For them the best is never quite good enough.

When these men ask what's new, they expect an answer—and usually get several. The "new" might mean an ultra sensitive camera to be used

editor's note:

On Sunday, May 25, 1958, in the broadcast series, "America on the Go," Alex Dreier, national radio and TV commentator, told his nine million listeners, over NBC-Monitor, of the progress and accomplishments in communications, electronics and photography. Mr. Dreier's tribute was a direct tie-in with the AFCEA 12th Annual Convention recently completed at the Sheraton-Park Hotel, Washington, D. C., and contributed materially to the success of the convention. We wish to express our profound thanks and appreciation to Mr. Dreier, NBC-Monitor and North American Van Lines, Inc., for making this event possible. In the photograph above, Mr. Dreier (right) is pictured with James D. Edgett, President of North American Van Lines.



in the comparatively new science of thermal photography . . . a high capacity and rugged air-floating disk magnetic memory unit . . . or a significant breakthrough in efforts to reduce the size of electronic circuits, accomplished with the speck-sized transistor for printed electric circuits developed by Diamond Ordnance Fuze Labs . . . or an ultra-magnifier that will quadruple the enlarging power of RCA's model EMU-3 electron microscope.

Maybe much of it is Greek to you, but that's all right. The important thing to know is that *these men know* what they are doing. And what they are doing is pushing America headfirst and pell-mell into the grandest, greatest period of scientific advancement in its young but fantastically progressive history.

America, 1958 . . . rushing headlong into a new technology that demands specialist's specialists. Great complexes . . . guarding our shores and guiding our missiles . . . making our lives more automatic, more electronic, easier, even healthier—and thus longer.

If you're still clicking away with your old-style box camera, you might be surprised to know that the Army Signal Corps' Night Hawk photo-reconnaissance system is on the job, giving field commanders low-level aerial photographs of what's doing over the next hill, in pitch-black darkness. Really quite simple, they tell you. The Night Hawk (or night drone patrol) combines a seeing eye in the form of a lightweight, rugged camera and an automatic flare ejector with the fast-flying ability of a small radio-controlled pilotless aircraft. The special camera slips easily into the drone fuselage and has no shutter in the conventional sense. Its lens is automatically uncovered when photography starts, and covered after a series of pictures have been taken. Simple . . . the man said!

Closed-circuit television comes into its own, employed in a photo-reconnaissance system where it provides the photo-navigator with an unobstructed view of the forward terrain in sufficient detail to permit him to identify significant landmarks and targets.

Then there's the fast pace of progress in the fields of microphotography and photomicrography. The former . . . the art or science of making microscopically small photographs . . . the latter . . the making of enlarged photographs of a microscopic object.

At Bedford, Massachusetts, the Air Force Cambridge Research Center has its sensitive hands in a wide variety of electronic pies. But one of the main objects of its intense research is to improve the systems and instruments that serve as visual and auditory senses for the Air Force, making possible the control and detection of incredibly fast missiles and planes — tomorrow's as well as today's.

Busy? Try your hand at aerial detection and interception . . . mobile, tactical air control systems . . . advanced radar for ground, aircraft and missile systems . . . automatic aerial control systems such as VOLSCAN . . . communications . . . data processing . . . magnetics . . . radiochemistry . . . weapons control systems . . . meteorology . . . auroral physics . . . storm detection . . . meteor physics . . . jet stream research . . . the mysteries of the upper atmosphere.

You can't tamper with such things and stand still. For these are fields of almost frenetic activity, where he who hesitates not only is lost, but may find his neighbor has zipped off to the moon, or devised an electronic robot that not only walks and talks, but pays taxes, too.

Color television is in uniform, too. You find it doing a work-horse job at the huge Walter Reed Medical Center near the nation's Capitol. There it serves as a magnetic kind of training and educational medium to bring the advanced techniques developed by the hospital's medical and dental centers to both Army and civilian medical men. And at Offutt Air Force Base—headquarters of our Strategic Air Command at Omaha, Nebraska — the electronic cyclops transmits briefing information, disseminates air intelligence and key weather data to any one or a combination of key viewing locations throughout the A-bomb-proof subterranean SAC nerve center.

The airline or military pilot, guiding his winged monster into a black and starless night, sees only a few yards ahead. Yet in a matter of seconds he can observe a wicked storm brewing directly ahead — 150 miles away! Within minutes he can plot a variation in his course . . . and soon be flying a safe, smooth route, unworried by winds or rains or anything else the unfriendly elements can throw his way.

The answer is radar: the 20th century magic that guides ships at sea and tracks man-made satellites in their cold and unfriendly journey through limitless space.

You discover that push-button warfare, which most people talk about in terms of the future, already is old hat, obsolete, because of things like the RCA Talos Defense system—the first completely automatic land-based system for launching and guiding missiles.

The defense unit receives target signals from remote outposts . . . analyzes them with regard to number of attackers, location, course and speed. Then computers determine the logical points of interception, order the missiles loaded on launchers, guide them at supersonic speed to the vicinity of the target. Then the missiles "lock" on . . . and close in for sure and swift destruction!

All of this . . . without even the touch of a button!

The kind of men who make these things possible will be gathering in Washington in just a matter of days now for the big Armed Forces Communications and Electronics Exhibition. And everything they do and say will somehow affect your life . . . in some way.

This big gathering in Washington June 4th - 6th will be directed by the Armed Forces Communications and Electronics Association, the AFCEA, whose members include some of America's most noted leaders. Rear Admiral Fritz Furth of International Telephone and Telegraph, is president, and among its directors are President Kappel of American Telephone and Telegraph, Ted Gary of General Telephone, George Bailey of the Institute of Radio Engineers, and General David Sarnoff, its first president from 1946 to 1949. The Chief Communications Officers of the Army, Navy and Air Force are all National Vice Presidents of the AFCEA, and on the membership roster are such names as General Twining, chairman, Joint Chiefs of Staff and his confreres, Burke of the Navy, Pate, Marines, Taylor, Army, and White, Air Force; also Lee de Forest, "Father of Radio;" Darryl Zanuck and Frank Capra of the films.

You can take the high road to Mars, or the low road from the launching pad of a Polaris, and these men are bound to get there before you.

Yet, you worry about the possibility of another world war — and you should. The men of the AFCEA, with their skilled know-how and futuristic techniques, can't hand you a perfect tomorrow all wrapped up in pink ribbon. But they *can* almost guarantee that through inspired research and development there *will* be a tomorrow . . . for you . . . and yours.

SEND DETAILS OF YOUR NEEDS for sizes

In keeping with the Signal Corps' 98th Anniversary theme, which features the outstanding accomplishments of the Corps and the industry of America in the related fields of research and development, SIGNAL is pleased to offer

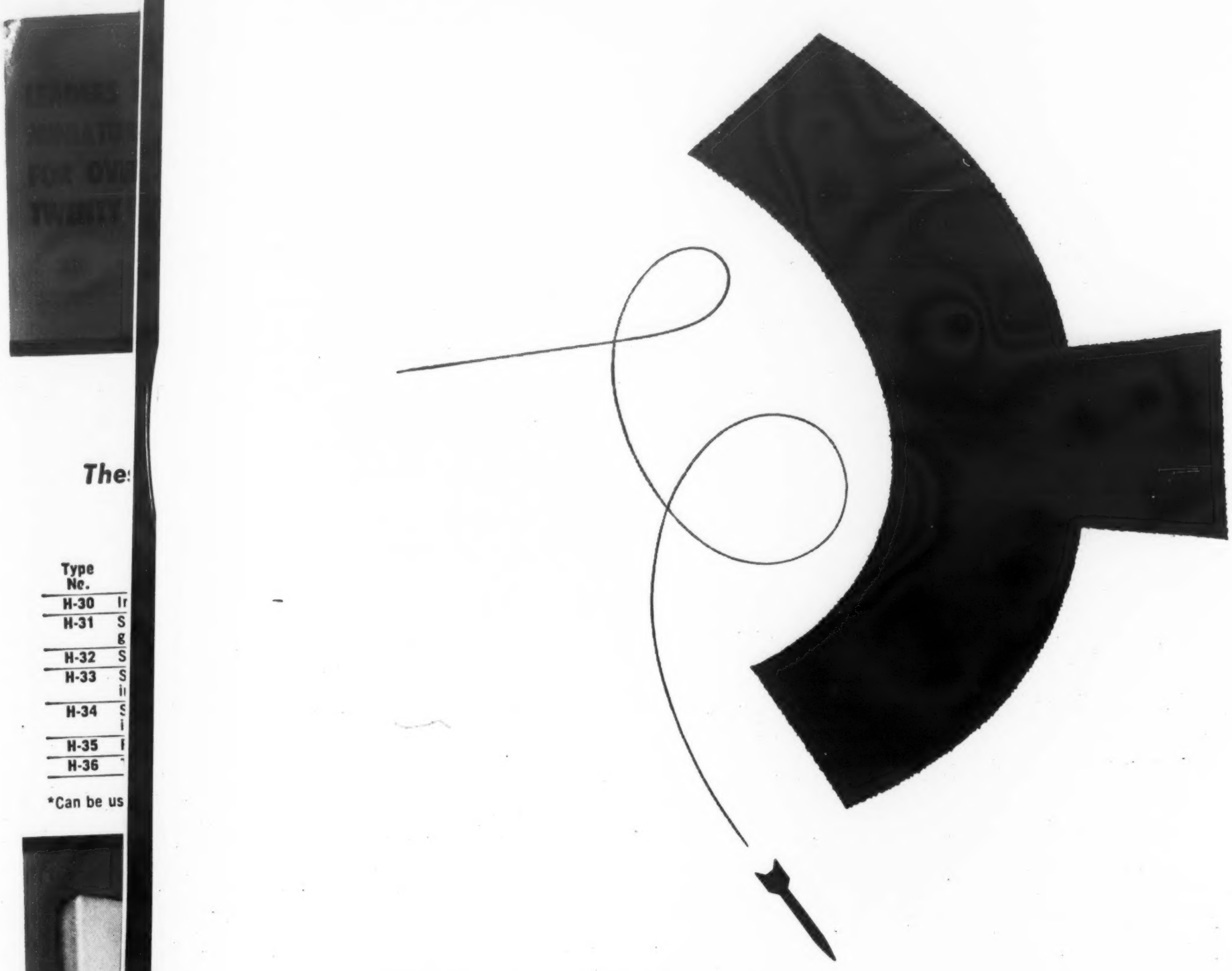
SCIENCE AND THE SIGNAL CORPS

by one of the Army's leading communicators,

BRIG. GEN. EARLE F. COOK, USA

Chief, Research and Development Division, Office of the Chief Signal Officer.

anniversary



MAKING MISSILES MISS...*TO SAVE YOUR LIFE*

Missile warfare may never come . . .

BUT IF IT DOES – then what?

Is there something we can do to stop, deflect or destroy an enemy missile screaming down from outer space – at a speed that staggers comprehension–carrying a warhead that can obliterate its target?

We've only a few minutes to act. Can we send an electronic bullet into its computing, calculating brain? Can we blind its radar eyes? Can we throw a meteroic roadblock in its path? Can we fool it into committing suicide?

The answers are found in secret devices and systems called "countermeasures"–designed to make missiles miss.

Electronic countermeasures. Other kinds, too

Many brilliant minds are working on the problem – including top scientists and engineers at IT&T who have been researching, devising, inventing...for more than 15 years. Today, no less than 156 engineers at one IT&T laboratory alone are working on countermeasures and nothing else.

This much can be told. A number of countermeasures exist today. Others are being perfected. Still others are being started from scratch–to be ready for whatever tomorrow may bring.

Many tools – many skills

Many tools are being used – radar, infrared, chemicals, others. Many skills are required – in physics, metallurgy, astronautics, as well as electronics. And thousands of IT&T technicians and artisans are working in these fields.

This is one of the big assignments the Department of Defense has asked IT&T to tackle. Guiding and controlling our missiles is another. Testing and launching them, too, and building communications between missile facilities.

The Air Force has even turned over to IT&T the all-important job of operating and maintaining the Distant Early Warning radar network in the Arctic, (the "DEW LINE").

Perhaps the missiles will never come. *But if they do* – countermeasures will be needed to make them miss. IT&T is working day and night to make sure the countermeasures will be ready.

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items is but a fraction of the total defense budget. Credit, too, for many advances must go to the Army's other technical branches and to our sister services.

To achieve its outstanding R&D record, the Army Signal Corps maintains one of the world's largest electronics laboratories, the U. S. Army Signal Research and Development Laboratory, employing some 3,500 persons, at Fort Monmouth, New Jersey.

The greater part of Army Signal Corps R&D funds is allocated to the Fort Monmouth Laboratory, but the U. S. Army Electronic Proving Grounds at Fort Huachuca, Arizona, the White Sands Signal Corps Agency in New Mexico, and other installations also participate.

All of the work, of course, is not done internally. The R&D progress of the Army Signal Corps, the constant battle to stay ahead of galloping obsolescence, could only be achieved through the widest possible cooperation with industry and other research organizations. Every year some 800 contracts for outside or joint research and development are let by USASRDL to industrial concerns, colleges and universities, and other organizations. And here it must be emphasized that because of this close liaison between Army Signal Corps R&D activities and civilian industry, the benefits of significant scientific breakthroughs are immediately passed on to augment America's over-all industrial capacity.

Foot Soldier Support

Some Army Signal Corps research approaches the basic, dealing in such esoteric subjects as advanced solid state electronics and dielectrics. But the importance of the foot soldier, the United States' most important weapon, is never forgotten. To give immediate support to the man in the fox hole, Army Signal Corps R&D has evolved a whole family of radio and wire equipments from the world's smallest walkie-talkie to huge mobile communications centers capable of handling radio, wire, TV, and facsimile.

The equipment family is keyed to the Pentomic Army and war of the future, nuclear or non-nuclear. Speed and dispersal dominate future tactics and strategy, and Army Signal Corps R&D has developed its Area Communications System with the aim that dispersal is no problem and speed of communications is limited only by human capabilities.

Every effort is being made to increase communication speed by substitution of electronic for human reaction time. Even many functions of the human brain are being replaced by electronics. Army Signal Corps R&D is working to bring to the battlefield automatic data processing systems using a family of computers. Already this family has reached a stage of development offering striking new capabilities in logistics, administration, intelligence, and tactical operations.

These electronic computers will be able to exchange data with each other, their automatic programming permitting rapid changes of machine routine when a command desires. Within range of our research and development are machines that will electronically scan typewritten or printed pages, reducing them to data form for storage or immediate transmission to eliminate time-consuming clerical and typing operations.

Computer Applications

Computer applications to the problems of the military are endless. In logistics, the inventory and assignment of personnel and material becomes almost instantaneous. Combat surveillance information concerning enemy and friendly troop movements, missile and artillery concentrations and a myriad of other considerations can be fed to mobile field computers for sifting and immediate display, enabling commanders to make the rapid decisions essential to success.

Other problem areas of great importance to the Army have, in the past, been solved manually by personnel in the field. Under our present mobile tactical concepts and because of the increasing complexity of our equipment, such efforts may be impossible in the near future. An example of this is the present method of frequency assignment in a field army. At this moment, studies are underway to determine the feasibility of and methods for the use of computers for frequency assignment.

Further fields of computer capability: trajectory, meteorology, and burst area—are of vital concern to other commanders, sometimes far removed from the mud of infantry combat zones. These are the men responsible for missile firings, ranging from the comparatively limited ranges of the Sergeant and the Honest John to the long distance punch of the Jupiter and other ballistic missiles.

First cousins to missiles are artificial satellites, blasted into orbit by missiles. Army Signal Corps research and development is directly responsible in some missile or satellite areas, notably the IGY albedo experiment, or cloud cover satellite, and the electrical power sources for almost all U. S. missiles and satellites.

R&D Contributions

But in the over-all "space age" field, the Army Signal Corps has made many major, if indirect, R&D contributions. It is safe to say that the United States would not have reached its present state in the related missile and satellite arts without Army Signal Corps research and development.

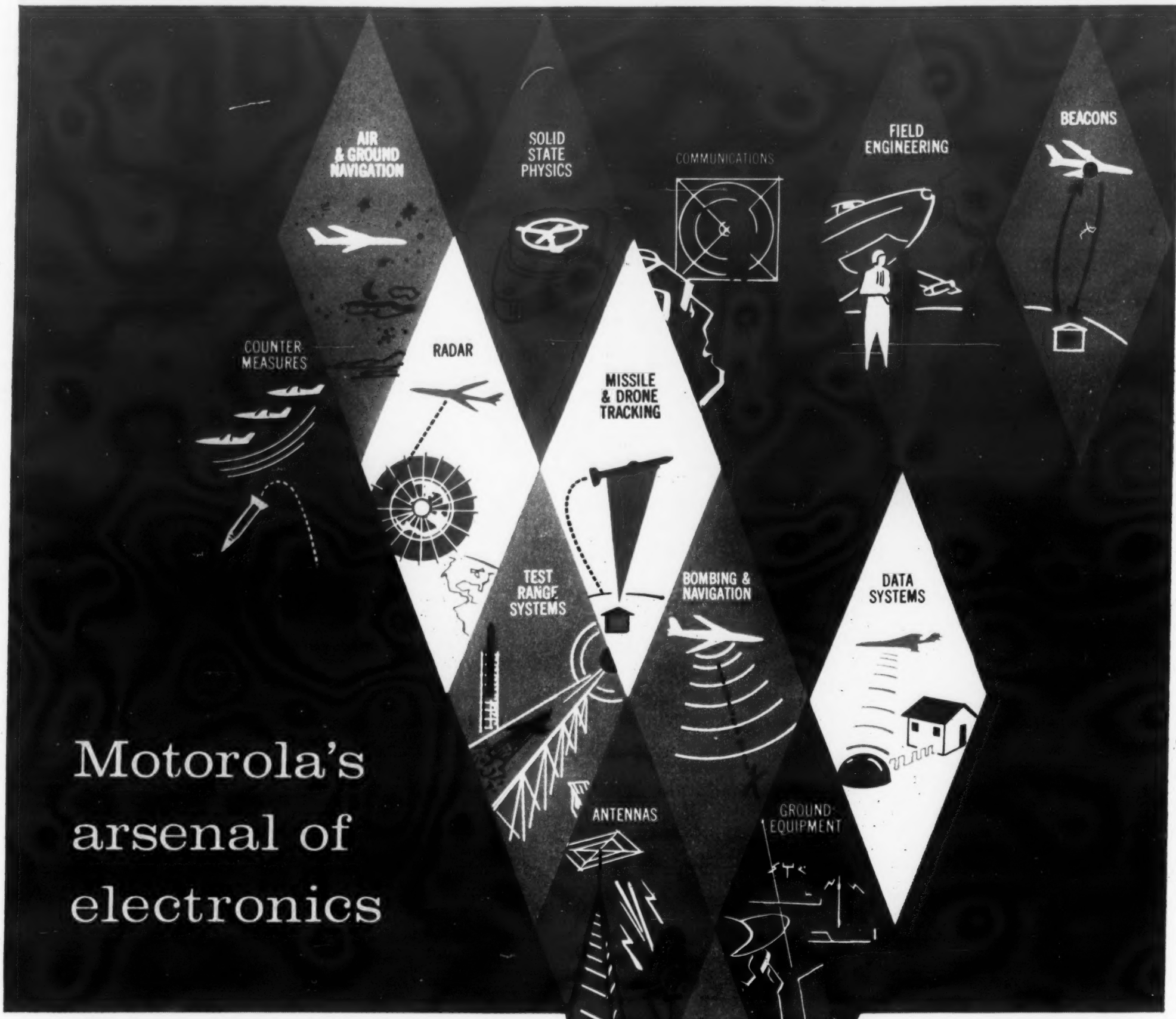
One excellent example is found in the Explorer I satellite. This satellite contains a geiger tube that measures cosmic rays, the tube requiring 700 volts of electricity with extremely precise limits. The batteries available in the Explorer, themselves researched at the Army Signal Corps Laboratory, produce between 4.5 and 5.5 volts. To make the geiger tube work, it was necessary to provide an extremely light power converter that would jump the voltage from the variable input to a precise 700-volt output.

No such converter was available on the commercial market when the decision was made to launch a satellite with a Jupiter C rocket, and no commercial manufacturer would undertake the task of producing one. The job was given to USASRDL and a transistorized converter weighing less than three ounces was designed from scratch and rushed to completion. It performed perfectly, with an output voltage variation of less than one percent.

Army Signal Corps pre-eminence in electronic research and development is evident in almost every phase of missile and satellite work, regardless of the agency with prime responsibility. Missiles, of course, are thrust from their pads by ballistic propellants, either solid or liquid. But without electronic controls, guidance and weather information, they would be little more than giant Fourth-of-July skyrockets.

Prior to the first proposed Vanguard firing and the actual Explorer launching, the giant Space Sentry transmitter at the Army Signal Corps Laboratory beamed powerful 108 megacycle radio pulses at the moon. The signals bounced back to the widely scattered Minitrack stations set up to receive satellite signals, permitting them to calibrate precisely their tracking instrumentation.

(Continued on Page 37)



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part II

electronics in the coast and geodetic survey

RAdm. H. ARNOLD KARO, USC&GS
DIRECTOR—COAST & GEODETIC SURVEY

figure 1

PRIOR TO 1946 THERE WERE ONLY minor applications of electronics to geodetic measurements and allied subjects. Recording of time intervals and the information necessary for astronomic and gravity observations were about the only ways electronics was used in pre-war times.

While Shoran was found useful in hydrographic surveys, it has been used even more extensively in geodetic measurements involving widely separated points. This method is known as Trilateration. (See photo below.) Recognizing the accuracy attained, geodesists saw the possibility of applying this technique to the measurement of long geodetic lines. A Coast and Geodetic Survey officer, assigned to the Armed Forces during World War II, probably contributed more to the study and development of the Shoran technique to geodesy than any other one person. In this application, the ground station transponders are placed at the ends of the line to be measured. The airplane with its interrogator unit flies across the line while measuring the distance to two transponders while in flight. The minimum sum of the distances measured, reduced for altitude, is then the distance between the transponders, or the length of the line to be measured. While not used to any extent in Coast and Geodetic Survey field operations, this bureau has contributed to many of the computational and technical ramifications necessary for the success of the method.

It is possible by the Shoran method with its measurement of lines up to three or four hundred miles in length to span inaccessible regions, particularly large water areas, heretofore impossible by orthodox geodetic methods.

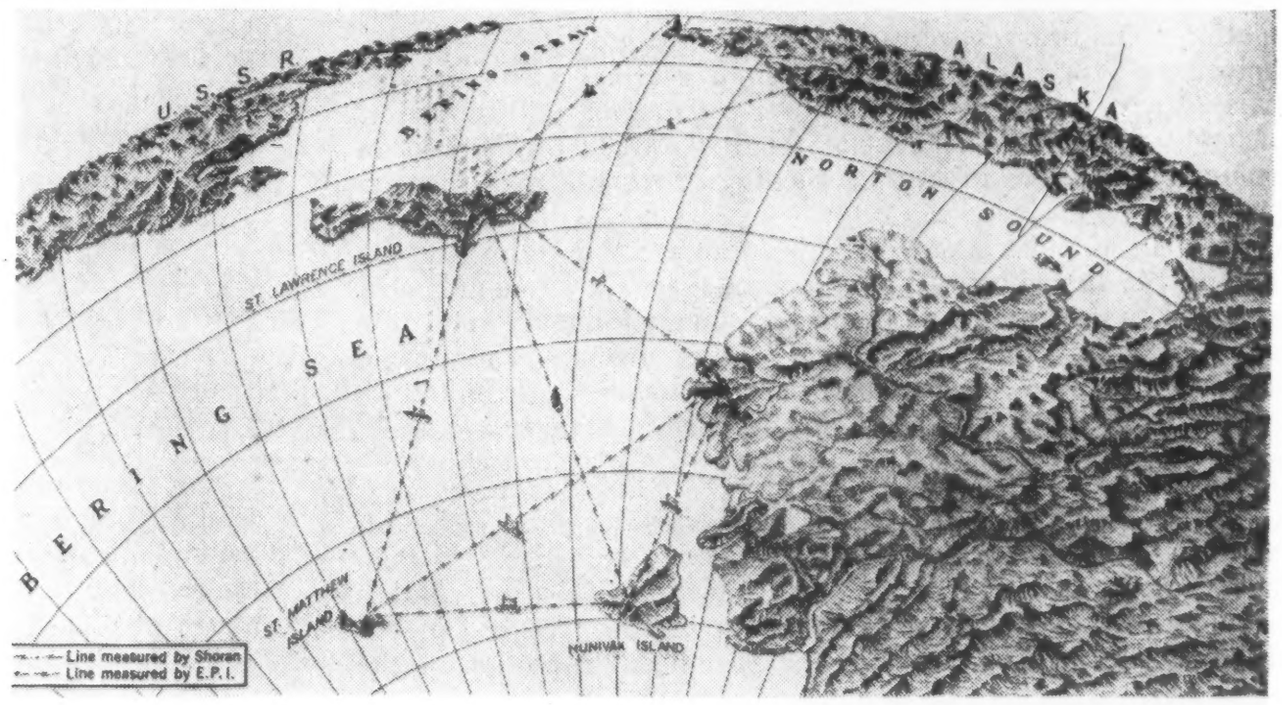
Another electronic geodetic measuring device with which this bureau has been quite active is known as the geodimeter. This instrument is used to measure shorter lines, usually distances of 20 miles or less. A Swedish development, the geodimeter is capable of great accuracy approaching that attainable with geodetic invar tapes. It is a modulated-light device which sends its beam to a bank of reflecting prisms which then send the beam back to the geodimeter. Distance measurement is accomplished by comparing the phase of the modulated light beam as it leaves the instrument with that of the phase of the returning light. The Bureau has used the geodimeter in the field for about two years, checking the accuracy of certain triangulation lines and measuring base lines in areas where the terrain makes it impossible for measurement by geodetic tapes. This electronic method has now found its place among the many other precise instruments.

Geodetic surveys result in an enormous quantity of observational data requiring laborious computation and adjustment. Electronic computers now perform a great bulk of these computations, thereby not only speeding up the processing of geodetic measurements but making possible large simultaneous adjustments heretofore considered impossible or entirely impracticable.

The extensive topographic surveying and mapping done by the Bureau in the United States and its territories for the production and maintenance of aeronautical and nautical charts, and for the location of aids to navigation, is now accomplished almost exclusively by photogrammetric methods. The photogrammetric procedure includes three principle phases — aerial photography; ground surveys to establish supplemental control and to clarify details on the photographs; and office processing including laboratory photography, photogrammetric bridging, and compilation utilizing various stereoscopic plotting instruments. Electronic devices are used in nearly every stage of this work and are becoming increasingly important to the accuracy and efficiency of the Bureau's topographic surveying and mapping.

Aerial photography, particularly that in remote areas such as along the coastline of Alaska, demands precise navigation. For this purpose, a Norden bomb sight is used as a view finder and sighting device. This is coupled with an automatic pilot to direct the aircraft along the photographic flight line, an extremely effective device that depends upon electronic components. This aircraft is also equipped with a radar altimeter used primarily for maintaining the flight

Part one of Admiral Karo's article appeared in the June issue of SIGNAL.



Trilateration by electronic method.

altitudes to very close tolerances. In the Instrument Shops, electronic devices are used to synchronize and time precisely the nine shutters of the Bureau's nine-lens, wide-angle aerial camera, a unique instrument designed especially for coastal mapping work of the Bureau. (Figure 1, page 11.)

Electronic instruments have not yet been used for ground surveys for photogrammetric mapping, but the Bureau contemplates having, in the very near future, a portable electronic distance measuring instrument, possibly combined with a theodolite, for traverse and for point locations along the shoreline and across bays and rivers.

In the Photographic Laboratory, glass diapositives for use on the stereoscopic plotting instruments and most of the contact prints from aerial negatives are made with the Log-Etronic printer that automatically measures the density in all parts of the negative and controls the light source to obtain maximum definition and clarity of details. This instrument greatly enhances stereoscopic instrument compilation that must, in the final analysis, depend upon the clarity of the aerial photograph.

Recent methods of adjusting long stereoplanigraph bridges between ground control utilize electronic computers for the computation of the final positions of all pass points. This procedure has resulted in the very appreciable increase in accuracy of position and has facilitated the entire procedure by reducing the density and former placement restrictions of ground survey control points. The survey is participating in current studies of analytical bridging techniques now made feasible by the availability of electronic computers and anticipates the replacement, in the not too distant future, of the present analogue plotting instruments by a two-step procedure combining stereocomparator measurements with electronic computations and adjustment of the entire bridge.

Electronics in Geophysics

The geophysical activities of the Survey are principally in the fields of seismology and geomagnetism. The electronic application to these sciences is showing continual increase. For many years the recording of three components of the earth's magnetic field has been on a light-sensitive film. This method is still standard but has one serious drawback in that the record cannot be viewed at any time without development of the film. A three-component visual-recorder was developed in the Electronics Laboratory which traces the terrestrial magnetic information in ink on a paper graph. Thus, it is possible to view the record at any time and detect any important changes as they occur. Visual magnetometers have been installed in ionosphere stations, where they are used in studies of the correlation between ionosphere soundings and the earth's magnetic field.

A similar electronic seismograph was designed by scientists of the Bureau. This has been used successfully for some years in the study of the earth's motion. Recently a telemetering system to work in conjunction with this seismograph was developed, since quite often a favorable location for the seismograph will be too isolated or too inaccessible as a recording site. The radio circuit is a 30-watt FM transmitter, tone-modulated by an audio subcarrier. Amplitude modulation of the subcarrier carries all the seismic information. On the recording end, de-modulated from the receiver, the tone is passed through a rectifier that supplies this slowly modulated signal to a recording galvanometer. Remote recordings have been made up to 20 miles and in some areas even greater recording distances can be expected.

Now in various stages of development, the following are among the instruments being designed to aid in geophysical research: the nuclear precision magnetometer, portable precise-timing circuits for numerous recordings where time is important and rotating coils and saturable-core induction equipment for measurement of the earth's magnetic field.

Tides and Currents Surveys

The recording of ocean tides and currents must quite often be done at remote places, and thus lends itself to telemetering methods. It is seldom convenient, and sometimes impossible, to record ocean currents in the area of current flow. When such is the case, the speed and direction of the current are transmitted to a more conveniently located r cording center.

Current observations were greatly improved and simpl fied by the invention and development of the Roberts rad current meter in the late 1940's. This remote current mea uring system operates unattended from radio buoys, si naling the direction and strength of current at any pred termined depth, permitting one field party to operate a many stations simultaneously. Current meters thus locate over a wide area provide, for practical purposes, the recor ing of currents in exact correlation over the entire area t be surveyed. Equally important is the elimination of a boa to occupy the current station, which can be expensive, in convenient and, on occasions, dangerous. By special arrange ment, a vertical profile of current can be obtained at eac station. This radio current meter station consists of a spe cially-designed, anchored buoy supporting an antenna abov and the current meters below.

The current meter is built in a streamlined housing which is suspended below the buoy in such a way that i will always head upward into the current. The passing ocean current turns the impellor situated in its nose through which a coupling and gear system operate keying contacts to transmit the velocity information. Directional information is obtained by a compass and contact system inside the housing, and direction is obtained by the time position of the direction pulse between the interval of the velocity pulses. For example, if this direction pulse is halfway between the velocity pulse, the current direction is 180°, or south. If it were a quarter, the direction would be 90°, or east.

All this information is sent up a cable to actuate a battery-powered buoy-type transmitter. This low-powered transmitter radiates on a frequency range of between 2 and 4 megacycles. A good short-wave receiver of standard design is used at the recording site. Recordings are made on a chronograph along with second markers from a break-second chronometer. Current observations from a number of stations can be made in a few minutes.

While the need to telemeter tidal information is not as extensive as with currents, in certain cases remote tidal recording is of considerable importance. Tidal behavior is a part of recent hurricane studies. Hurricanes accompanied by high tides and wind sometimes make it impossible to reach the tide gage site, and remote recording becomes necessary. Close watch must be kept on tidal conditions at such times. Remote recording is also necessary in some areas, such as Alaska, where it is possible to locate a float well but it is difficult to read the gage at this well. In order to reach the gage, small boats must sometimes be used in areas of strong currents and choppy seas.

Two types of remote-recording tide gages are now in use. When recording over short distances, not exceeding a few hundred yards, the tide well float and the recorder are coupled through a selsyn system. When long distance recording is needed, a commercial telemetering system is used. This system converts the tidal heights to electrical pulses of length proportional to these heights. These pulses may be transmitted over wire through standard rented telephone lines or over a radio link. A special recorder at the receiving station reconverts the pulse lengths to proportional position of a recording pen on a graph, which moves with respect to time.

Conclusion

Progress is achieved only by pioneering in new and unexplored fields. Each successive decade over a period of 150 years has seen progressive broadening of the scope and importance of Bureau operations. Improved techniques, equipment and instrumentation play a major role in the expanded operations required to keep pace with national demands for products and services.

The electronic era ushered in a vast new medium of extending and refining surveying techniques. This great new technological aid has provided the means of increasing the range, facility, accuracy and productivity of almost every phase of Coast and Geodetic Survey operations.

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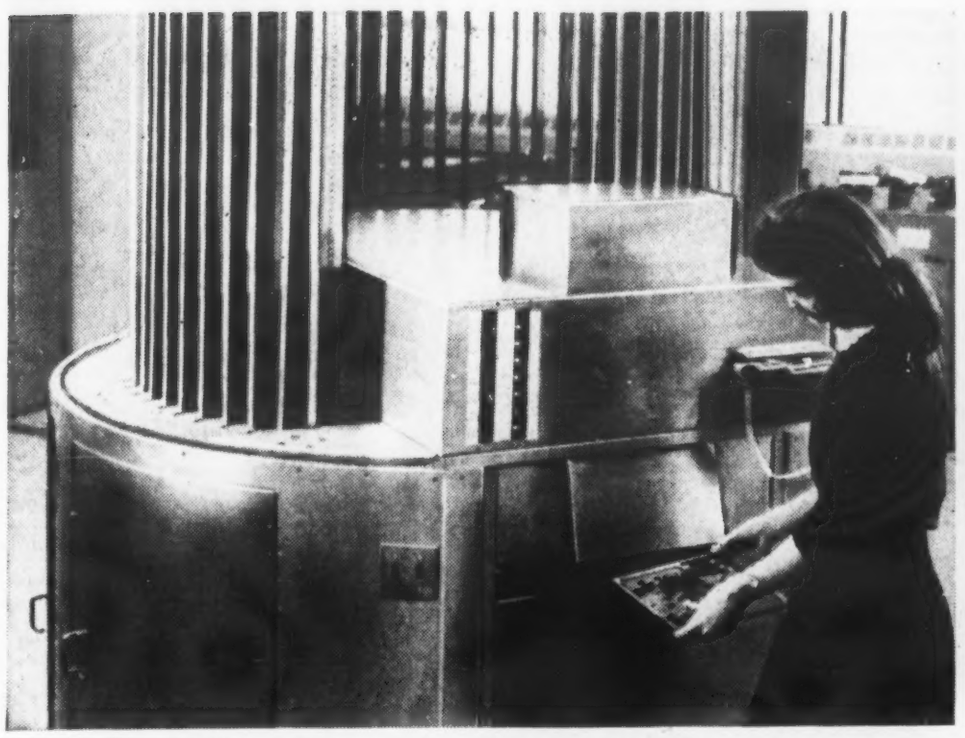
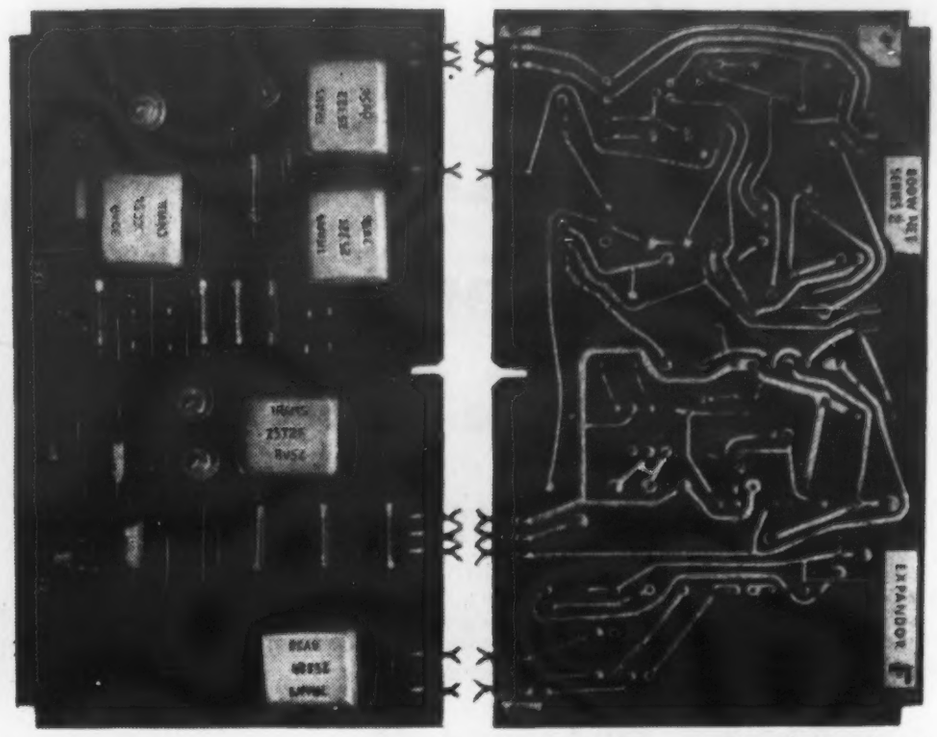




This 7-foot high machine can handle up to 50 different components stored in the magazines on top. These components are mechanically selected and mounted on carrier circuit boards by use of a punched tape program control system. • Illustrations on the right show component and circuit sides of a typical circuit board assembly used in P Carrier telephone equipment.

Solved: the mechanized mounting of circuit components for carrier telephone equipment

Carrier telephone equipment makes possible the simultaneous, independent transmission of several messages over the same pair of wires. Modern carrier systems manufactured by Western Electric for the Bell System make extensive use of plug-in circuit units which are interconnected to form the terminal or repeater equipment.

Until recently, one of the knottiest problems faced by engineers responsible for manufacture of carrier equipment was to speed up slow, costly hand mounting of components onto the circuit boards. Possibility of mechanizing the process was made extremely complicated by reason of the large variety of component types, sizes and weights used. Furthermore, the mechanized process had to accommodate a large variety of circuit designs – each calling for selection of different combinations of components.

The Answer: Faced with this complex problem, Western Electric engineers developed a versatile machine in which components are stored in magazines and automatically selected, transferred and mounted onto circuit boards under the control of a punched tape programming system. This Automatic Component Insertion Machine, planned for line operation in the near future, will eliminate manual mounting of approximately 3,000,000 axial lead type components upon 150,000 P Carrier circuit boards each year.

How does it work? Using a punched tape program control system, the following operations are coordinated and performed:

1. The circuit board is moved and locked into position by a servomechanism to receive properly each component as it is selected.
2. The selected component is dropped into the pick-up position by an electromagnetic device (there is one at the release end of each magazine hopper).
3. A rotating transfer arm picks up the component and delivers it to the inserting head which has been adjusted to the length of the component by a servomotor.
4. The inserting head grasps the component by its axial leads, cuts them to the proper lengths and forms them into a U-shape ready for insertion into the circuit board.
5. The inserting head lowers the component to the circuit board where the leads are inserted and clinched against the under side by two rotating anvils.

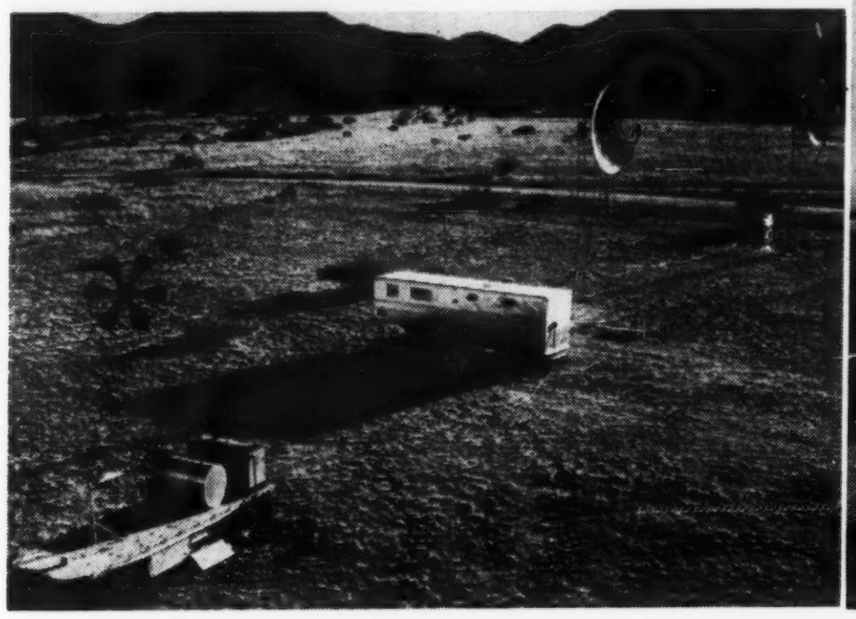
The development of this ingenious machine is another example of the exploratory engineering constantly going on at Western Electric. It is another example of how Western Electric effects economies in the manufacture of Bell telephone equipment – to the end that your telephone service is ever better and more dependable, and at low cost.

Western Electric

MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM

COLLINS TRANSPORTABLE POINT-to-POINT COMMUNICATION SYSTEMS

by J. B. Mathis
Collins Radio Company
Senior Assistant Field Engineer



THE CHANGES IN WEAPONS FOR today's and tomorrow's war machines have resulted in a definite need for extensive changes in military communication system requirements. Modern, complex weapons have placed operational and logistical demands on the field commander which preclude the use of single-axis, echelon-to-echelon type communication. The dispersal of tactical units over a much wider operational area to minimize the effects of special weapons has created the need for a new concept of tactical communication. As a result of this new concept, there is a requirement for several types of new equipment.

During the past decade, many significant contributions have been made to line-of-sight microwave, Transhorizon (scatter) and point-to-point HF communications systems.

As early as 1945, a Transhorizon study was undertaken by Collins Radio Company investigating the transmission and behavior of UHF radio signals. The results of this and other studies provided a basis for the design of a complete Collins Transhorizon communications system. The first application of this exclusively scatter system was to provide approximately 72,000 route miles of voice communication circuits for the DEW line in the Arctic.

Early development efforts were concentrated on communication systems for fixed-station service. However, the urgent need for highly mobile, multichannel systems, which could be assembled and tested at a factory or depot and moved rapidly to a desired field site, was recognized. The first such systems were mounted in semi-trailer vans. These vehicular systems have proven to be highly successful for all applications where the desired operating sites were accessible by road, and where the operational time scale is consistent with normal truck speeds. However, for military applications, where site access by road is questionable and where minimum transport time is a prime consideration, there existed an urgent need for air transport. With these facts in mind, this program has been carried forward to yield a completely air transportable, ruggedized line of high capacity microwave, UHF scatter and point-to-point HF SSB communication systems.

A significant feature of these systems is lightweight construction, which provides maximum mobility and a minimum set-up time. These systems are unique in that they offer a wide range of operating frequencies and types of communication services.

A significant contribution to the mobility requirement is represented by a completely transportable microwave system for operation in the 5925-8500 mc portion of the radio spectrum. This portable system provides 48 FDM channels, in either terminal station or repeater station configurations, housed in

* *(Left) Collins TST-101 Ground-Transportable Transhorizon (Scatter) Terminal is housed in a 31-foot van-type trailer, completely equipped with a heating unit, 6-ton air conditioner and work and sleeping area. A second trailer shown in the foreground carries the dismantled antenna and tower sections, guy wires, the RF transmission line, a 37.5 kva Caterpillar diesel power unit and a fuel tank with 450-gallon capacity, sufficient for 160 hours of normal operation. (Right) Inside view of the exciter-receiver terminal in the Collins AST-101 Air-Transportable Transhorizon (Scatter) System.*

hut shelters, thereby facilitating transport by helicopter or conventional surface vehicle of the four-by-four variety. Additional channeling equipment may be installed in a second hut to take advantage of the 120-channel capacity available in this type system. Teletypewriter sub-carrier channeling equipment is also included.

Single sideband suppressed carrier multiplexing permits high channel loading of the RF system to achieve maximum signal-to-noise ratio on each channel. RF and multiplex equipments are designed to be an integrated communication system regardless of the number of channels added. Remotely-controlled passive reflectors are employed which permit rapid alignment and orientation from the ground in order to obtain communication between any two stations with the least practicable delay.

The concept of the mechanical design of this system was based primarily on planned methods of its transport. Originally designed for transport by aircraft, the systems also occasionally require movement by surface vehicle. A study was made to determine the frequencies and accelerations to be encountered in transporting the basic shelters, and to determine the type of shock and vibration isolation system required. Results of this investigation were incorporated in equipment design which have materially contributed to the operational success of this system.

A new offset-feed parabolic antenna is used with this system. In older antennas radio energy is fed to the antenna reflector from the focal points in the center of the reflector or "dish." A portion of the radiated energy is reflected back into the waveguide feed, causing standing waves. A high voltage standing wave (VSWR) has the effect of reducing power, increasing distortion, and generally degrading the signal. The feature of directing the energy at the reflector from the side prevents the formation of standing waves from this cause. This antenna includes coarse and fine adjustments in three axes.

The RF transmitter employs a type 5976 or similar klystron to generate a 5925 to 8500 mc microwave carrier capable of being frequency modulated by a wide-band signal source. The rated RF power output of the transmitter klystron is 100 milliwatts into the waveguide. The rated frequency stability of the microwave carrier is ±0.05% (.02% with transmitter AFC). The frequency deviation of the transmitter klystron is ±3.0 mc when used in normal communication systems. The signal voltage required from the stabilized gain modulator to produce this deviation is less than 9 volts rms.

The microwave receiver is of the superheterodyne type and incorporates a waveguide filter to preselect the microwave signal before converting it to a 60 or 70 mc intermediate frequency. The preselector has a nominal passband of 22 mc, centering at the receiving frequency. The local oscillator of the receiver is a type 5976 reflex klystron similar to the one used in the transmitter. It is adjusted to produce RF energy at a frequency 60 or 70 mc below the frequency of the received signal in order to produce the desired intermediate frequency.

Transportable UHF Transhorizon System

This vehicular-transportable Transhorizon system features either a 1 kw Collins TST-101) or 10 kw (Collins TST-102) scatter terminal, with the option of 4-, 12- or 24-voice multiplex channels in the 755 to 985 mc region of the UHF band. This system consists of a self-contained transmitting and receiving station mounted in a 31-foot van type trailer and a separate 24-foot flat bed antenna and power trailer upon which are mounted two de-mountable 15-foot diameter parabolic antennas, a Caterpillar Diesel Power Unit and associated fuel tank. For applications where primary power is desired from a central source and where maximum mobility (other than air transport) is an important consideration, the 24-foot flat bed trailer may be omitted and air inflatable parabolic antennas substituted for standard aluminum parabolas.

The major subassemblies which make up the radio transmitting and receiving equipment of this system were similar to those tested on the DEW line.

Collins AST-101 Air Transportable Systems, utilizing tropospheric scatter propagation, provide multichannel operation over single radio circuits in the 755 to 985 mc frequency range, with outputs of either 15 watts or 1 kw. As featured in the Collins TST-101, the major subassemblies which make up the radio transmitting and receiving equipments of this system were similar to those tested on the DEW line. In interest of maximum mobility, the power amplifier has been repackaged and installed as a permanent part of its transport shelter.

Each terminal consists of two air-transportable shelters and a two-wheel engine generator trailer, transportable by 6 x 6 truck, air cargo C-119 aircraft or larger. One of the shelters is capable of operating independently of the second shelter as a complete 15 watt low-powered terminal requiring only a primary power source and channeling (terminal) equipment inputs. This shelter contains the exciter, dual-diversity receivers and necessary transmitting and receiving filters. The second shelter receives its power from the first and provides a power output increase to 1 kw.

Stored within the shelters during transit are lifts for loading and unloading from aircraft or vehicle, plus two 15-foot inflatable parabolic antenna systems. Dollies may be attached to move the shelters over a short distance at the site.

The entire Collins UHF air transportable family utilizes the air-inflatable antenna system—an obvious tactical feature. The inflatable parabolic antenna was designed by Collins for the ground transportable or air transportable UHF communication systems. Two units are available, differing only in mounting: one for mounting on the hut and the second for ground mounting, with necessary vertical support. Both units have the same reflector assembly, inflation equipment, feed and feed support. The feeds, however, vary with frequency. Two mounting assemblies are available: one for motor controlled azimuth adjustment and a second for manual control.

The principal advantages of an air inflatable antenna over a conventional type are in weight and storage volume. An additional advantage results from the short time required for its erection or dismounting at an operational site. The complete inflatable antenna and tower for mounting the axis of the reflector 23 feet above the ground weighs approximately 675 pounds and may be stored in a volume of 2 feet wide by 2 feet high by 8 feet long. Two conventional parabolic surfaces fabricated from expanded metal and designed for transportable use require the major portion of a 24-foot flat bed trailer and weigh 1350 pounds. These weights do not include transmission lines.

The reflector has a 6-foot focal length and is 15 feet in diameter. A choice of four feed horns, depending on desired frequency (1000 mc, 2000 mc, 4000 mc or 8000 mc), provides a 10 db illumination taper.

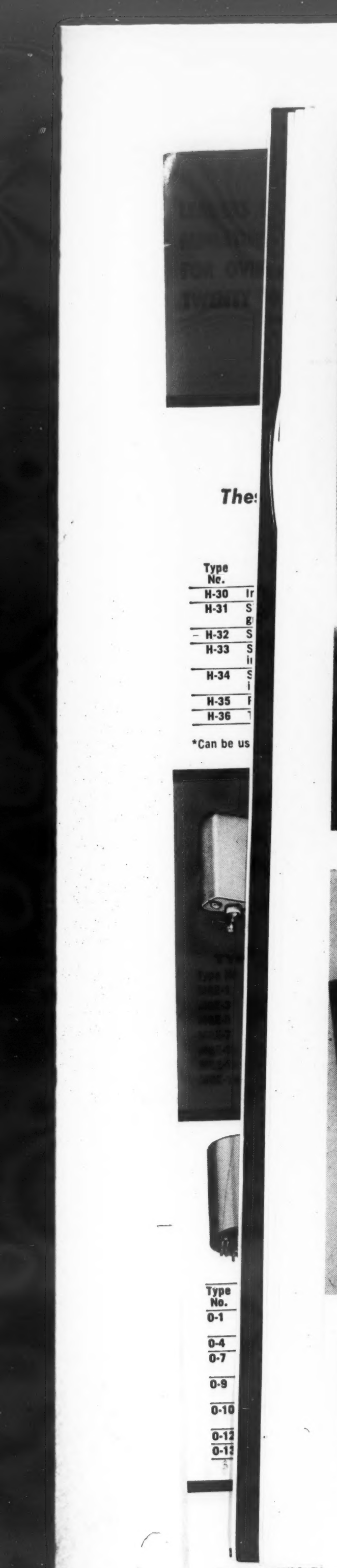
Another series of terminals offers Transhorizon or line-of-sight communication in the 2 kmc, 4 kmc, and 8 kmc bands. The engineering and packaging concept is similar to that of the Collins AST-101, and the same inflatable antenna is used. The flexibility inherent in modular equipment design enables packaging terminals in one or two hut type shelters. A complete 1 kw terminal can be housed in one shelter measuring 142 inches long, 85⅝" wide and 82½" high.

The two-station configuration may be preferred in many applications for greater ease of transport. In the 2 kmc, 4 kmc, and 8 kmc terminals, one shelter by itself offers 1-watt line-of-sight service utilizing the exciter-modulator equipment; the second shelter, containing the power amplifier, enables full 1 kw output. Development of a 50-watt module will give added power capability to the exciter shelter for line-of-sight applications.

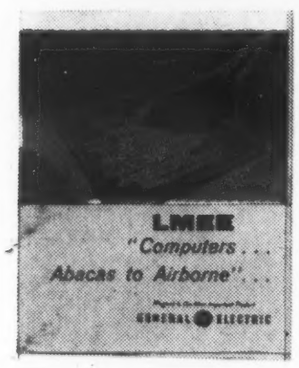
Various configurations of equipment in the two shelters are possible; for example, the two diversity receivers might be split up between the exciter-modulator shelter and the PA shelter.

An integrated series of exciters provides coverage of the 1700-2400 mc, 3700-5000 mc, and 7125-8500 mc frequency ranges. All are capable of accommodating 132 voice channels of frequency division multiplex (FDM) with 12-552 kc baseband, or, alternately, a single high resolution television channel. Each individual voice channel can

(Continued on Page 20)



GEVIC a new concept in military airborne computers



SMALL—0.8 cu. ft.—LIGHT—45 lbs.—with speed and capacity to perform all computation functions for an advanced fighter-bomber—this is one version of **GEVIC**, General Electric's new variable increment digital computer. **GEVIC** is based on General Electric developments of new mathematical techniques and solid-state logic elements. For information on how **GEVIC** and other computer developments can benefit your aircraft, missile, or other applications, send for new LMEE brochure . . . "Computers . . . Abacas to Airborne." Write Dept. 6S

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A DEPARTMENT IN THE DEFENSE ELECTRONICS DIVISION

— GOVERNMENT —

NEW RADAR IN MISSILE MASTER An advanced long-range search and height finding surveillance radar has been installed in the U.S. Army Missile Master System at Fort Meade, Md. One of the major advancements in the new radar, the FPS-33, is a high gain antenna which increases range coverage by more than 50%. The radar system was developed, produced and installed for the Army by the General Electric Co. and is the principal source of target data input for the Missile Master. (See Feb. 1958 SIGNAL, p. 24, "Missile Master"—An Electronic Air Defense Control System.)

HELIPORTS The U.S. Senate recently approved a resolution authorizing a study on the construction of heliports in the District of Columbia. This study could become a model for legislation to bring the benefits of helicopter travel to other cities. The total number of 470 helicopters now engaged in commercial operations will undoubtedly become greater and require larger facilities.

BILL TO AID EDUCATIONAL TV A bill authorizing Federal grants of up to $1 million in each State to aid the development of educational television has been passed by the Senate. State agencies or nonprofit organizations would be eligible to receive grants for broadcasting equipment to be used for educational purposes. The FCC has set aside 242 TV channels for the use of noncommercial educational stations, but so far, only 31 such stations are on the air..

NEW CALL SIGN PREFIX FOR AMATEUR STATIONS The FCC has given notice that when single letter K or W prefixes are no longer available for assignment in a continental call area, such as the second and sixth call areas, two-letter prefixes will be assigned. The WA prefix will be assigned to all ham stations of novice class operators. When practicable, the WN prefix will be assigned to the stations of novice operators; otherwise the WV prefix will be assigned.

MEETING THE DEMAND FOR AIRBORNE INSTRUMENTS Collins Radio Company has formed a separate Airborne Instrument Manufacturing Department to facilitate the production of airborne instruments. The new department was formed as a result of the Company's continued expansion in the flight control instrument field. Instrument production facilities at Collins have more than doubled in the past six months.

CONTRACTS: ARMY: Packard-Bell Electronics Corp., production of mobile electronic equipment which assists in the detection & identification of friendly aircraft, $750,000; Motorola, Inc., radar reconnaissance systems, $1,600,000; Western Electric Co., ground guidance equipment for the NIKE-HERCULES missile, $66,000,000, North Electric Co., telegraph terminals & converters, $4,700,000. NAVY: Raytheon Manufacturing Co., electronic controls for the TARTAR missile, $6,340,000; Westinghouse Electric Corp., to design and furnish long lead-time reactor compartment components for 5 nuclear-powered submarines in the FY '59 shipbuilding program, $17,900,000; Ampex Corp., airborne magnetic recorders and spare parts, $1,238,000; Stelma, Inc., teletypewriter distortion monitors, $35,353. AIR FORCE: Collins Radio Co., airborne high-frequency SSB communications system, $2,750,000; Tele-Dynamics, Inc., telemetric data transmitting set, $199,888; Radiation, Inc., timing terminal unit, $25,000; General Precision Lab., spare parts for amplifier antenna computer coupler, $604,000.

— INDUSTRY —

DIALING IN THE DARK The Automatic Electric Company is now manufacturing a new telephone with a number plate that utilizes a "panelescent" lamp which illuminates through translucent numerals and letters, enabling callers to dial in a darkened room. The lamp, which consists of a porcelainized steel sheet with a ceramic-phosphor coating, requires no bulbs, tubes, filaments or cathodes.

WESTREX CORP. TO CHANGE OWNERSHIP Preliminary negotiations have been completed for the purchase of Westrex Corp., a wholly owned subsidiary of Western Electric Co., by Litton Industries, Inc. Westrex distributes and services abroad a line of communications products and equipment for the motion picture industry and domestically, it specializes in distributing and servicing sound recording equipment for motion picture and phonograph record industries. Litton specializes in the manufacture of computers, data processing equipment, commmunications and navigation apparatus, business machines, microwave tubes, and electronic components.

FACSIMILE MACHINE OPERATES ON BOTH ENDS UNATTENDED A new robot facsimile telegraph transmitter that feeds messages to itself mechanically and transmits them automatically to destination in picture form, was publicly demonstrated at the AFCEA Convention for the first time by Western Union. Called a flat-bed transmitter, the facsimile machine can send telegrams, letters, cards, memos, drawings and other communications, one by one, on a continuous automatic basis. At destination, a "slave" facsimile recorder receives and cuts off the message automatically and then readies itself for the next message.

ELECTRONIC HIGHWAY OF TOMORROW recently went into operation at RCA's David Sarnoff Research Center at Princeton, N.J. Cars entering the grounds of the research center pass over electronic loops buried in the entrance road. Transistorized detector units connected to the loops count each of the passing cars, measure the speed of each, and flash a polite warning saying "Slower Please" to every driver exceeding the posted speed limit. The new equipment is a transistorized variation of the comprehensive electronic vehicle control system developed earlier by RCA and demonstrated last year at Lincoln, Nebraska.

TEXAS INSTRUMENTS SELLS PANEL INSTRUMENTS FACILITIES AND PRODUCT LINE The Sun Electric Corporation of Chicago, Illinois, has purchased the panel instruments manufacturing facilities and product line of Texas Instruments Incorporated. Sun Electric will provide service to all former Texas Instruments panel instrument customers. Texas Instruments announced that it had discontinued its panel instrument manufacturing activity to devote the space and effort involved to other phases of its expanding electronics development and manufacturing activities.

— GENERAL —

6 GREAT LIVING AMERICANS The U.S. Chamber of Commerce has named top scientist Dr. Wernher von Braun as one of the ~~six~~ "Great Living Americans" for his contribution in advancing the age of rockets. Others named were: Dr. Jonas Salk, for his achievement in medicine; Allan B. Kline, former President of the American Farm Bureau Federation; J. Edgar Hoover, Director of the FBI; Miss Calla E. Varner, a skilled and devoted school teacher, now retired; Richard Mellon, for his personal leadership in the rejuvenation of the city of Pittsburgh; Charles F. Kettering, Director and Research Consultant for General Motors Corporation.

MILEAGE SURVEY Mileage payments to salesmen driving their own cars on company business have reached an all-time national high of 8.84 cents per mile, according to an independent survey by Emkay, Inc., leading national auto fleet leasing firm. This represents a jump of 12½ per cent from a year ago when the national average was 7.72 cents per mile. The most popular mileage rate was 8 cents per mile.

CALL FOR IRE PAPERS: Prospective authors are requested to submit abstracts and summaries of their technical papers for the 1959 IRE National Convention. The deadline date is October 24, 1958. Additional information may be obtained from Dr. George L. Haller, Chairman, 1959 Technical Program Committee, The Institute of Radio Engineers, Inc., 1 East 79 Street, New York 21, New York.

SPECIAL EVENTS:

AUGUST 6-8: The AIEE 1958 Special Technical Conference on Non-Linear Magnetics and Magnetic Amplifiers will convene at the Hotel Statler, Los Angeles, presenting four technical sessions. Exhibits will be displayed by 40 manufacturers.

AUGUST 13-15: The Professional Group on Instrumentation of IRE, AIEE, and NBS are sponsoring a conference on Electronic Standards and Measurements to be held in Boulder, Colorado, at the NBS Labs and University of Colorado. Papers and discussions at a national level will be presented in six technical sessions.

AUGUST 15-17: The 10th National Amateur Radio Convention of the American Radio Relay League will be held this year for the first time in Washington, D. C., at the Sheraton-Park Hotel, by the Foundation of Radio Amateur Clubs, Inc.

AUGUST 19-22: The West Coast Electronic Manufacturers Association and 7th Region of IRE are sponsoring the 1958 Western Electronic Show and Convention (WESCON), at the Ambassador Hotel, Los Angeles. There will be 829 exhibit booths on display at the Pan Pacific Auditorium.

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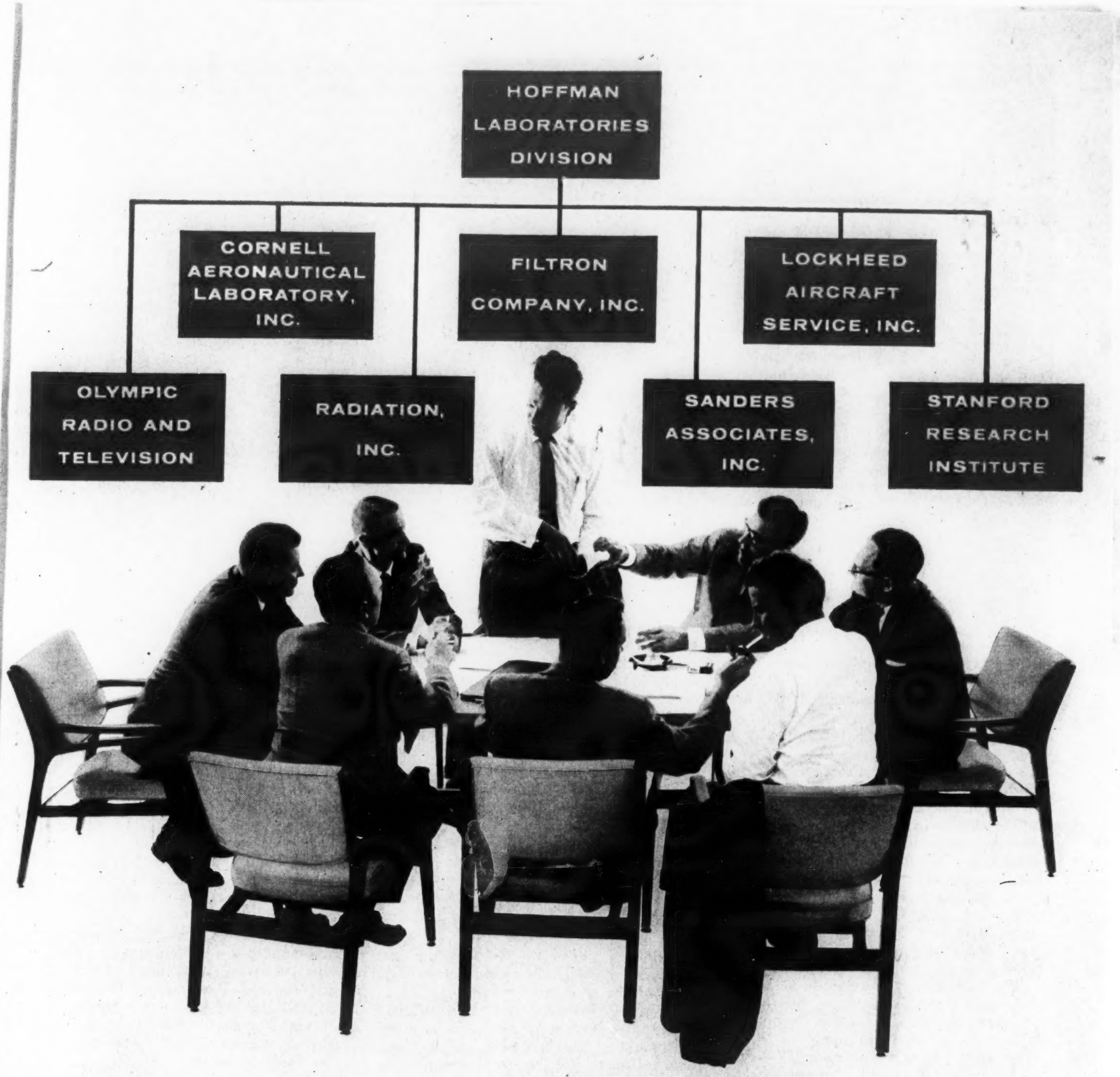

The Team behind Tall Tom

The Hoffman TEAM approach (Total Engineering and Administrative Management) is a new concept in electronic systems management. Under the leadership of Hoffman as prime contractor, the TEAM is concentrating the maximum engineering capabilities of eight selected firms on development of the Air Force's highly sophisticated TALL TOM (AN/ALD-3) Electronic Reconnaissance System. The TALL TOM TEAM gives promise that the complete system will be delivered at a substantial saving in time and money.

By utilizing with optimum efficiency and economy the specialized talents of any number of large and small organizations, the Hoffman TEAM concept is directly applicable to research, development and production of other complex electronic systems. Inquiries are invited regarding the application of this unique Hoffman TEAM approach to your systems problems.

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Significant developments at Hoffman have created positions for scientists and engineers of high calibre. Please address inquiries to Vice President, Engineering

Collins

(*Continued from page* 15)

accommodate up to 16 teletypewriter channels. An order wire circuit can provide ringing and full party line operation, while a carrier circuit in the service channel assembly enables order wire transmission above the video band when transmitting TV. In FDM operation the exciters are crystal-controlled to provide high stability for minimum bandwidth and optimum signal-to-noise ratios, particularly in low capacity applications. For TV relay, where the transmission bandwidth is much greater, a klystron modulator with simple AFC is employed. The 1 watt output of the exciter is provided by an amplifier utilizing a traveling wave tube. The 1 kw power amplifier employs four-cavity, air-cooled amplifier klystrons. Waveguide bandpass filter diplexers are used to permit simultaneous transmission and reception on one of the antennas.

Receivers for the 1700-2400 mc, 3700-5000 mc and 7125-8500 mc ranges are low-noise FM systems operating on single, preassigned frequencies. In voice or teletypewriter scatter reception, they receive FM signals of up to 4.5 mc bandwidth, modulated by frequencies up to 600 kc, and operate as double conversion superheterodynes. Injection frequencies are derived by multiplying the output of crystal controlled oscillators. Collins MX-101 or equivalent military multiplex is used in these terminals to convert the baseband to individual voice channels, as well as to provide the baseband for modulation of the exciter in transmission. In Transhorizon reception, a combiner assembly combines the outputs of the two diversity receivers into a composite signal with signal-to-noise ratio equaling or exceeding that of the best receiver. High definition television signals with low index FM can be received by interchanging or switching IF assemblies.

These terminals use the air inflatable antenna. One of the three feed horns is used, depending on the frequency range, for a 10 db illumination taper. The feeds are of the open-ended waveguide type. Air inflatable waveguide offers the solution to problems of weight, bulk and performance in transmission lines for these UHF and SHF portable terminals.

A versatile air transportable HF SSB communication system for military tactical requirements may be implemented by the use of four basic hut configurations. Independent absolute frequency control techniques permit extreme stability for both voice and teletypewriter communication. The system may be operated compatibly with AM equipment. Since no carrier is used with SSB, distortion and selective fading effects are essentially eliminated. Narrower bandwidth helps reduce interference and facilitates multiplex operation.

Typical System Configuration

The type A hut houses a Collins KWR-6 1 kw Transmitter, a Collins 50E-1 receiver, frequency standard, transmitter antenna coupler, voice multiplex terminal equipment with associated filter, telephone switchboard and patch panel which will accommodate 90 pairs. Duplex operation is employed, with up to four voice channels and two teletypewriter channels. Provision for simplex operation facilitates initial set-up of radio circuits.

The type B hut provides simplex or duplex HF SSB operation and is equipped with an air-to-ground or mobile UHF channel with a 25-mile range. A KWR-6 transmitter, 50E-1 receiver, frequency standard, HF transmitter antenna coupler, AN/URC-9 UHF transceiver, AN/FGC-25X teletype, cryptographic equipment, teletype patch panel, TH-5/TG Telegraphic terminals and audio control panel comprise the major units included in the shelter.

The type C hut is a receiving facility. Equipment used consists of two 50E-1 receivers, frequency standard, antenna coupler filters, voice multiplex with required filters and a line patch panel. Provision is made for interconnection with the type D hut. An AN/FGC-20X teletypewriter and TH-5/TG telegraph terminal may be used for monitoring.

The type D hut houses two KWR-6 transmitters, a frequency standard, antenna coupler, voice multiplex transmit equipment, together with necessary filters and amplifiers. A patch panel allows the selection of desired output lines. Provision is made for use of an AN/FGC-20X teleprinter and TH-5/TG telegraph terminal. Type C and D huts supply additional communication channels at any installation where type A facilities are insufficient. Channel selection is made in the type A hut. However, the type C and D huts can be operated as a separate station by making suitable connections to the type C shelter.

Antennas

All huts utilize two 30-foot whip antennas. One is mounted on the shelter, to minimize transmission line length for transmitter installations. The second antenna is self supported and is connected by a coaxial cable. It may be located up to 500 feet from the shelter. An antenna coupler filter located at the base of the second antenna allows simultaneous receiver operation on a frequency removed 10% from the transmitter frequency. The type B hut employs an additional UHF antenna for mobile communication.

AN/TRC-69

The Collins AN/TRC-69 Single Sideband System is another communication facility that may be quickly installed and made operational in any desired location with minimum difficulty. Power output is 1 kw PEP from 2 to 20 mc and 800 watts from 20 to 29.999 mc. Compatible operation with existing AM facilities is provided. A telephone switchboard permits connections with landlines. Personnel may communicate with airborne stations in the same manner as in ground telephone systems, using simplex or duplex operation.

Housed in a fiberglass-insulated aluminum hut are two receiver-exciters, a power amplifier, automatic antenna coupler, frequency controls and a telephone switchboard. Power is supplied by a separate engine-generator unit. All radio equipment with the exception of the frequency controls are at the top of the console. The frequency controls, a shelf for logs or message forms and the telephone switchboard are located in the console center section.

Space for typewriters or teletypewriters is provided on either side. Additional equipment space is available above each typewriter compartment. FSK and loop current supply may be located beneath the counter should the addition of TTY facilities be desired. An air conditioner assures personnel comfort during sustained operation. A workbench is provided for maintenance personnel.

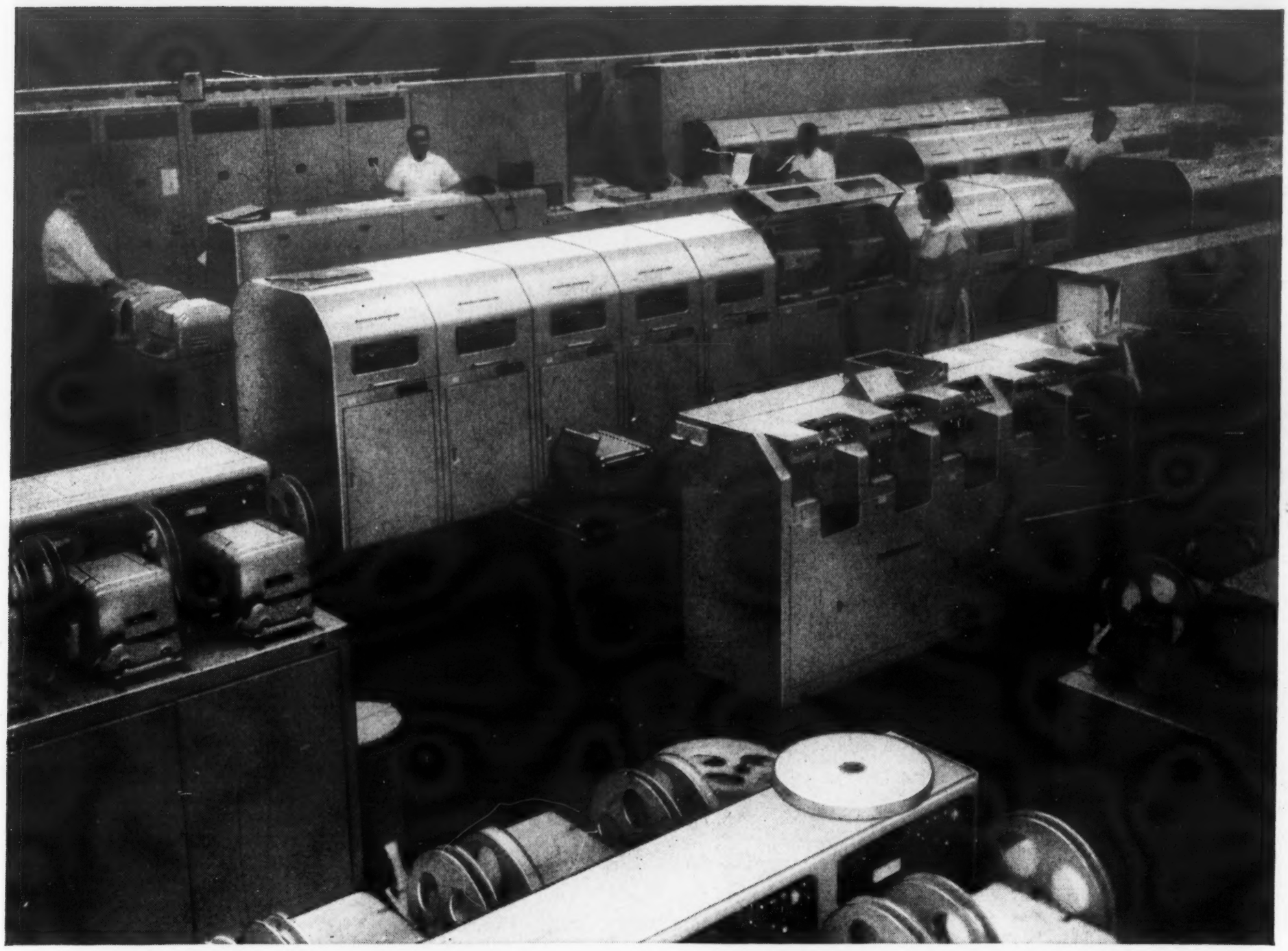
The equipment used in the AN/TRC-69 is similar to the Collins AN/ARC-58 Airborne HF SSB Communication System. Continuous coverage of the frequency range in 1 kc step, with fully automatic tuning, is accomplished by merely rotating four knobs. The channel frequency indication is directly in kilocycles. Channel selection time is nominally 15 seconds. The highly stable mixer injection frequencies are provided by a stabilized master oscillator referenced to a compact frequency standard with a stability of one part in 10^9 per month. The single sideband generators consist of a balanced modulator and mechanical filter. The operator may select: upper sideband; lower sideband; upper sideband and reinserted carrier (for AM compatibility) or twin sideband (both sidebands and suppressed carrier). Distortion is minimized by the excellent linearity of the power amplifier.

Modular construction facilitates "maintenance by replacement," appreciably reducing associated logistical considerations. Power drain is reduced through extensive use of transistors and saturable reactors. Effective cooling provides maximum reliability and assures long component life.

A 30-foot collapsible "whip" antenna is utilized for this system which may be stored within the shelter.

The new tactical concept of the military stresses mobility, greater fire power through new and improved weapons systems, increased control through advanced communication and a multitude of other features made possible by significant technological achievement over the past decade. Such a concept requires an effective, flexible and responsive support system. This system must enhance the command communication without depriving the commander of the prerogative to usurp the communications at will. Above all, the system must be capable of handling without disruption the maximum load placed upon it, enabling the field commander to communicate effectively.

SEND DETAILS OF YOUR NEEDS



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Research and development of equipment for transmitting and receiving printed communications has been a continuing project at Kleinschmidt for almost 60 years. This unparalleled store of experience, now joined with that of Smith-Corona Inc, holds promise of immeasurable new advances in electronic communications.

KLEINSCHMIDT

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A Field Calibration Service for Army Electronic Test Equipment

Interior of mobile calibration van showing precision standards and calibration equipment.

by T. E. Gootée - Office of Technical Liaison - Office of the Chief Signal Officer

ACCURACY OF ELECTRONIC TEST equipment is essential to the proper repair and maintenance of Army electronic equipment at all echelons. If test equipment is inaccurate, the operational equipment will be inaccurate. Radio communication sets may be off frequency causing interference, radar sets may malfunction and be ineffective, and other electronic and communication apparatus of the Army may operate inefficiently or not at all—for the want of accurate, standardized testing and measuring instruments.

It's not enough for maintenance and repair teams to have particular types or enough items of test equipment. Each piece of equipment must be calibrated accurately, and rechecked and recalibrated regularly.

To assist Army field installations in maintaining the accuracy of electrical and electronic test equipment, the Signal Corps has instituted a new nation-wide—and ultimately world-wide—service to further its mission of "service to the soldier in the field." It is known as the Field Calibration Service, and consists essentially of a fleet of mobile laboratory vehicles which tour specified areas to provide on-the-spot calibration of Signal test instruments and equipment at U. S. Army Signal Corps maintenance sites, Ordnance NIKE missile batteries, and other installations.

Each mobile calibration laboratory is contained within a reconverted 36-passenger van which is equipped with the most precise testing, measuring and calibrating instruments available. It also stocks some repair parts—such as precision resistors, capacitors, and basic meters—to service ineffective or inoperable measuring and testing equipment within permissible limits.

The first vehicle of this type went into operation in the Sixth Army Area, based at the Sacramento Signal Depot—where the van was originally designed and developed for field use. There is now a mobile calibration van operating in each of the ZI Army Areas which provides needed service to installations in all parts of the United States. By late spring, a van is to be in operation in Europe, under control of USAREUR. And three additional vans will supplement coverage in the six Army Areas of the United States.

The merit of the calibration service has been proved through trial by actual operation. It has greatly improved the quality of field maintenance of electrical and electronic equipment and has effected notable savings to the government and the taxpayer in terms of both time and money.

Significant to its success is the historical development of the Field Calibration Service of the Army Signal Corps.

A decade ago there was need for a comparatively few and simple types of electronic test equipment. But this gradually changed. Beginning with the general adoption of radar as an instrument of modern warfare and progressing to today's necessity for the complicated control of guided missiles and missile systems such as the Missile Master (see February 1958, SIGNAL), there was a continuing, increasingly urgent need for improving and insuring the accuracy of electrical and electronic test equipment. Through the years this need has grown vastly in priority and importance.

Because of the extreme complexity of modern electronic military equipment, accurate test equipment is essential to the timely detection of equipment failure and subsequent repair.

Long recognized by the Army Signal Corps has been this need for accuracy and standardization, and continuous and progressive efforts

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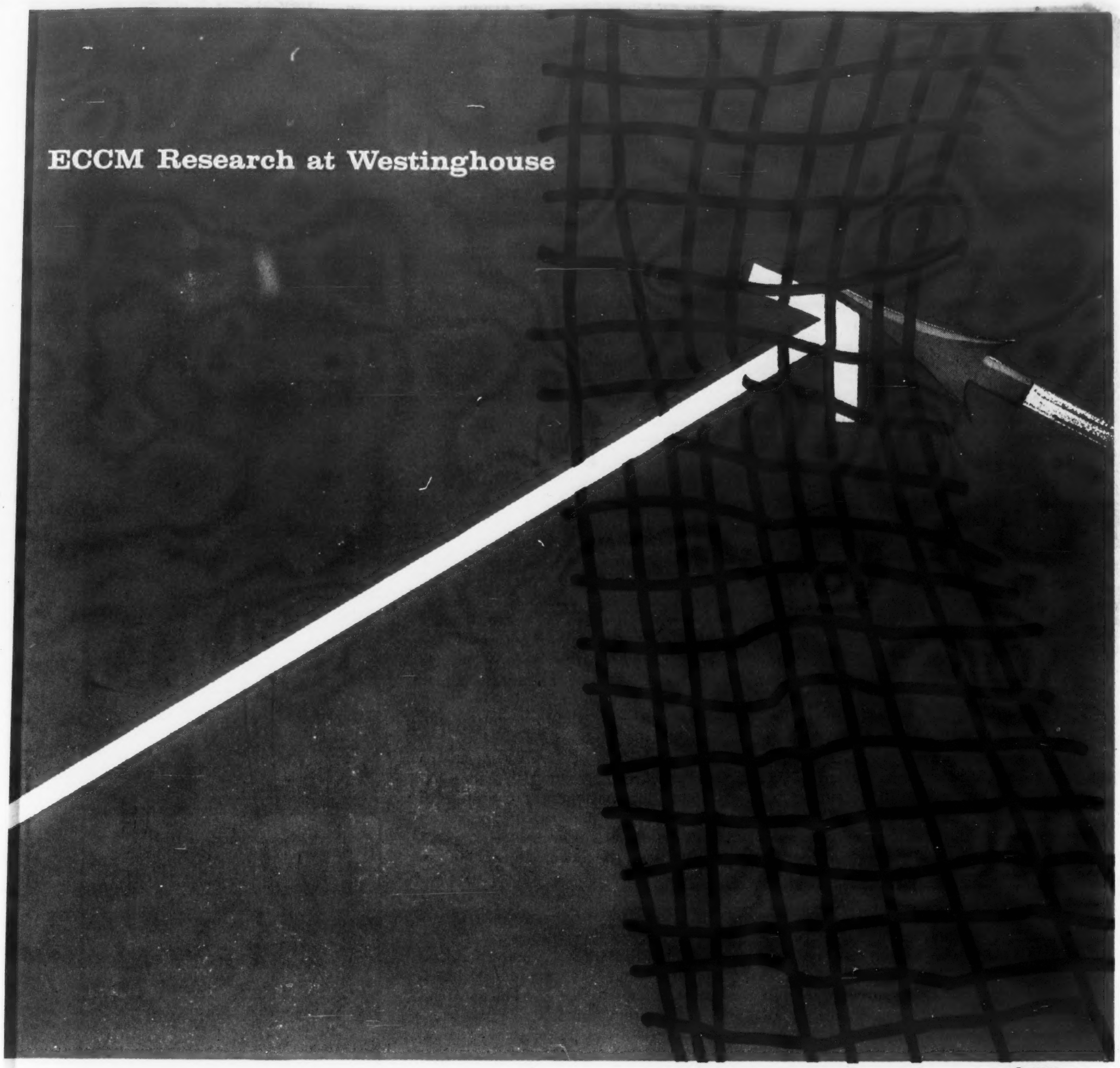

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DATA PROCESSING
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Calibration (*Continued from page 22*)

were made to meet the stringent requirements of modern weapons and their associated electronic apparatus.

At least one solution was *not* adequate: the "calibrate and return to user" program. This experimental program failed because of the reluctance of field units to relinquish test equipment long enough for shipment to a base maintenance shop for calibration, and return. Also, the equipment was frequently damaged in transit or had lost the accuracy of its calibration through normal transportation hazards.

Although long considered impractical due to the delicate nature of the physical standards involved, the solution seemed to be some sort of mobile calibration facility. As the direct result of technological advances, portable electronic test devices were developed with more compact and more rugged physical standards. And instruments required for calibration checks were also simplified.

In recognition of these technological advances, studies were made at the U. S. Army Signal Depot at Sacramento, California, which culminated in the development of a proposal to establish a mobile facility—a service—to resolve the field calibration problem.

Accordingly in 1955, the first calibration van was assembled for testing in the Sixth Army Area. A shop truck was converted for the purpose. And the equipment required was procured largely from commercial sources since few of the physical standards had been made available to the Armed Services.

After two years of operation, the calibration van had proved its purpose and verified its existence. Visits had been made to all types of field maintenance activities. and a continuing evaluation had been made of the adequacy and benefits of the services rendered.

The need for the specialized service exceeded all expectations. On initial trips it was found that an average of *only thirty per cent* of the equipment in use by the field units visited *was within calibration limits and completely serviceable.* On second visits to the same field installations—nine to twleve months later—this percentage of serviceability increased positively *to more than 55 per cent.*

Limitations inherent in the original calibration van were detected during this trial period and additional standards were subsequently incorporated to take care of known deficiencies. Frequent checks were also made to evaluate the stability and ruggedness of the vehicle itself.

After traveling more than six-thousand miles during a 16-month period and checking more than two-thousand separate items of test equipment, the only failure was a single vacuum tube.

Based on evaluated experience, standard operating procedures for the improved model of the mobile calibration van were developed. The equipment, and the procedures, are used today in the calibration vans presently in operation and in the others to come.

Design

To allow maximum effectiveness in all types of weather, an original 36-passenger vehicle requires considerable modification to become a field calibration van.

The body of the vehicle is sealed and insulated to eliminate dust seepage, and is equipped with an air conditioner and a heater. Formica-top work benches are constructed lengthwise along both sides of the interior, with drawers and closets below the surface. The drawers are so designed that they must be lifted slightly to open, thus preventing motion during road movement of the vehicle. A line of fluorescent lamps over each work bench provides excellent illumination. And a system of sponge-rubber pads with straps and clips holds all calibration equipment securely to the bench tops while in transit.

Fundamental standards of voltage and resistance are derived from units previously calibrated by the National Bureau of Standards. Provision is made for frequency measurement up to 12 kilo-megacycles, which is approximately 12,000 times greater than the frequencies of regular radio broadcasting stations. Frequency calibration is maintained by reference to the standard frequency broadcasts of the National Bureau of Standards.

The mobile calibration van is usually manned by three electronics specialists who operate from Signal Depots and Signal Sections of General Depots.

All things considered, in its present form the mobile calibration van represents the best and most efficient method of providing such a calibration service to the Army. Any other means would require many times over the expenditures for both equipment and manpower. Thus, this calibration service is a significant achievement of the Signal Corps.

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Tiny Variable Vacuum Capacitors

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TYPE A-10/3 WITH CERAMIC ENVELOPES

Especially suited for the needs of telemetering and other miniaturized electronic equipment, these new UNITED vacuum variable capacitors represent the latest and most effective solution to many complex problems.

RATINGS

Capacitance range	2 to 10 uuf
Max. peak RF voltage	3000 volts
Maximum RMS current	1 ampere
Maximum temperature	500° C
Shaft revolutions	5 turns
Net weight	4/10 oz.
Nominal overall dimensions less connector lugs	Length: 1 9/16" Diameter: 5/8"

For dielectric stability and maintenance of precise setting of capacitance in high altitude, high temperature environment, *there is no other class of capacitor that can equal these new vacuum variables.* Capacitance variation control is straight line.

Your inquiries are cordially invited.

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part II

the importance of electronics in

PSYCHOLOGICAL WARFARE

by Captain Albert R. Laue, Signal Corps
Instructor, Psychological Warfare Department
USA Special Warfare School
Fort Bragg, North Carolina

Part I of Captain Laue's article appeared in the June issue of SIGNAL.

SYNOPSIS OF PART I: *Psychological warfare is basically a process of mass communication by which the emotions, attitudes, opinions and behavior of specific foreign target groups can be influenced. Based on communications, it owes its very existence to electronics.*

ASSUMING THAT PSYCHOLOGICAL WARFARE OPERATORS normally know what effect they want to achieve, what target groups they can reach and what means they have at their disposal to communicate with these target groups, the one all-important question that still demands an answer is, "What are we going to say to our target audiences in order to achieve the effect we want our communications to have on them?"

At first glance this question appears to be of elementary simplicity. Actually, however, it poses one of the greatest problems in psychological warfare planning and operations. In the past our failure to solve this problem correctly has resulted in such "boners" as our attempts to influence peasants of certain backward areas by painting for them a rosy picture of the average American farmer's life replete with automobile, television, automatic washer, refrigerator, home freezer, and whatnot. To these audiences an automobile was something they knew was reserved for high government officials and therefore of no interest to them, and the other items were plainly figments of the imagination, which proved that the Americans were either crazy or liars, or both. The subject of these communications was beyond the "frame of reference" of the audience and therefore failed to achieve the desired effect. The audiences simply were not capable of responding positively to ideas with which they were incapable of identifying themselves. Consequently these communications were neither meaningful nor persuasive.

The crucial question therefore is: How can our psychological warfare operators so phrase the content of their communications so that it will be meaningful and persuasive in terms of the frame of reference of the target audience? The obvious answer is: The operator must "place himself in the shoes" of his target audience. He must think the way they do, must know their problems, beliefs, aspirations—in short, their way of life. For the average adult American to place himself in the shoes of and think like a peasant of Lower Slobovia is obviously an impossible feat. Consequently, psychological warfare has come to depend to a great extent on area specialists to take the guesswork out of communication content. Area specialists are people who are either natives of potential target areas, or who have lived among the target groups for some time, or who have made an intensive study of the target areas or groups. By virtue of their background and training, they can more readily project themselves into the frame of reference of their respective target groups.

Area specialists, however, have two serious defects. First, they are human beings, and as such they are subject to such human weaknesses as fading memory, biased perception, and mortality. Secondly, they tend to lose the true frame of reference of the target group as soon as they are physically removed from that group and assimilated into another cultural framework. The longer they have been away from the target group, the less they become representative of that group. Take the example of an American missionary who spent thirty years in a certain province of China and was then forced out by the Communists, say seven or eight years ago. In those seven or eight years, the frame of reference of the people in that area has undergone tremendous changes, while his has not. Therefore his usefulness as an area specialist would be very limited today unless he had somehow managed to keep up with every new development in that area since his departure. Furthermore, unless this man had recorded every bit of information relative to that area in his possession—a process requiring a considerable expenditure of time and effort—all his knowledge would be lost at his death.

Attempts have been made to accumulate and store all available knowledge on potential target areas in so-called area studies or area guides, and to keep these guides up to date by constant addition and revision. These area guides are a form of insurance against the risk of knowledge being lost with the demise of the knowledgeable. However, they have the distinct disadvantage in that the extraction and assimilation of the information required for a specific operation involves a long and tedious study of the material compiled in the guides.

The problems of communication content are further complicated by the fact that, within a given area, we have not just one but a multitude of target groups, each with its own peculiar frame of reference. In our mythical Lower Slobovia, for instance, we may find such diversified potential target audiences as government employees, industrial workers, housewives, members of the armed forces, political leaders, peasants, intellectuals, members of youth organizations, the clergy, and so on. Even the most versatile area specialist cannot normally be familiar with the frame of reference of more than one or two of these groups.

ADPS Solves Complex Problems

The Automatic Data Processing System can solve these complex problems with ease and speed. Unhampered by human limitations, it has an unlimited capacity to record and store all human knowledge on all potential target areas,

and to organize and categorize the information. Its memory is unfailing and unencumbered by biased perception or interpretation. It can review all the information in its possession in terms of specific problems and come up almost instantly with the correct solutions. Assuming, for instance, that the system has absorbed and "digested" all available information on Lower Slobovia, we can now ask it such questions as: "What shall we say to the peasants of Lower Slobovia to persuade them to adopt more modern agricultural methods?" In this case we have specified the desired effect and the target group. The system, having "reviewed" all the information it possesses on that group in terms of the desired effect, will tell us how to gear the content of our communications to the frame of reference of our target audience.

With equal ease and reliability, ADPS could give the psychological warfare operator of the future the correct answers to each or all of the questions contained in the formula "who says what to whom, by what means, and with what effect." We could, for instance, ask the system: "If we tell the peasants of Lower Slobovia that the average farmer in America begins his day with a hearty breakfast of orange juice, bacon and eggs, toast and coffee, what will their reaction be?" Chances are that the system would, after again scanning all its information on the target group, come back with the answer: "They couldn't care less." While the "who" in most cases seems fairly obvious, it is not necessarily so. A communication addressed to industrial workers, for instance, could be more effective if it were sponsored by an American labor organization. The "to whom" may also pose a problem in certain cases. For instance, a communication dealing with the scarcity of consumer goods in Lower Slobovia would be more meaningful and therefore more persuasive if addressed to the housewives rather than any other potential target group. The question "by what means" may arise in cases where we have the capability of communicating with our target audience by a number of media. If the illiteracy rate of the target group is very high, for instance, we would use the audio media in preference to the printed media.

In spite of its superhuman capabilities, ADPS will not eliminate the area specialist. On the contrary, it will increase the area specialist's productivity and usefulness by providing a convenient means of instantaneously and effortlessly recording all the information he may possess or gather. It allows the area specialist to concentrate all his efforts on the gathering of information instead of having to expend a large part of his time and effort recording that information. ADPS will do away, however, with the need for the voluminous and cumbersome area guides and with the laborious research job involved in extracting pertinent information from such guides.

Looking Ahead

There are countless other examples that could be cited to illustrate the important and vitalizing influence of electronics on psychological warfare. The few examples presented above, however, will suffice to illustrate the point clearly enough. No wonder, therefore, that if you ask anyone involved in psychological warfare how important he thinks electronics is in his field, his answer would be: "All-important." He knows that, without electronics, psychological warfare would not have reached its present impressive stage of development. He also knows that, if further progress in electronics should suddenly cease, technical progress in psychological warfare would be seriously retarded. On the other hand, he is thoroughly convinced that, if psychological warfare is to meet the challenges of the world of today and tomorrow, it cannot, it must not, and dare not be static. To play successfully the increasingly important role thrust upon it in a world-wide struggle for the minds of men, phychological warfare must be as dynamic as the age we live in. To those of us who see in the psychological warfare effort of the United States and its allies a powerful force on the side of truth and liberty, it is indeed comforting to see the impressive continuing progress of the American electronic industry.

Personnel Available

As a service to AFCEA members, SIGNAL will make space available in this column for those members who are interested in employment in the communications, electronics and photography industries. Any member is entitled to three insertions in the magazine on a space available basis, free of charge. Please limit your notice to 5 lines. In replying, employers are asked to address: Box ....., SIGNAL, 1624 Eye St., N. W., Washington 6, D. C. Letters will be forwarded to the AFCEA member.

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Development of the Sig C Field Telegraph

Beardslee Magneto-Electro Telegraph

1861-1863

DEVELOPED FROM EXPERIENCE with a unique train of field telegraph equipment hand-built in 1861, the first electric signaling device designed and procured in numbers for the U.S. Army was a portable field telegraph. The device was self-contained and generated its own current by the turning of a crank revolving a set of magnets. It was the Beardslee magneto-electric telegraph set and was in fact the first electrical instrument produced in quantity for U. S. military use. As such, it stands as the ancestor of an extraordinary prolific family of the ever more wondrous electronic progeny which characterizes this fantastic age. The Beardslee telegraph sprang from the efforts of three men, one Army officer and two civilian electrical engineers.

Major Albert J. Myer, appointed Signal Officer of the Army on 21 June 1860, had already worked out a neatly effective system of flag signals. Previously an Army surgeon, he had long been interested in the deaf and in sign language. He also had an interest in the new, and for that day wondrous, electric telegraph. In fact, he had worked for a while in his youth as a telegraph operator. The commercial telegraph, not yet 20 years old, involved poles with insulators standing off bare wire lines through which flowed the current put out by heavy storage batteries placed in the telegraph stations along the pole lines. In 1861 under conditions of war, this telegraph system was not well suited to the needs of the armies for which Maj. Myer had to provide field signals. A telegraph adapted for field use seemed definitely needed for occasions when visual signals, wigwag flags or night torches, could not be observed because of adverse weather or terrain. Major Myer, sharing with his countrymen the national characteristic of practical adaptiveness, at once set about accomplishing that development.

When in August 1861, a month after the battle of Bull Run, a prominent telegraph engineer in New York, Henry J. Rogers, took note of Army General Orders which attached Maj. Myer to Gen. McClellan's staff for visual signaling duties in the Army of the Potomac, he wrote the Signal Officer: "Please advise me . . . if you are also to have charge of the Electric Telegraph in the Field, as I have some suggestions to offer . . ." Maj. Myer hastened to reply the very next day (24 August). "I shall probably organize a telegraphic or signal train . . . I intend to visit New York for this purpose when I shall wish to see you . . . and will with pleasure carefully examine your inventions."

The outcome of that meeting in the late summer of 1861 between the Army's Signal Officer and a civilian engineer (Rogers had assisted Morse in building the original 1844 telegraph line between Baltimore and Washington; he had served subsequently as superintendent on various telegraph lines and had contributed improvements and inventions in telegraphy) led to the Army's first field telegraph, or signal train, often called a flying telegraph train. Composed of several wagons and wire carts, the train was sometimes called "flying" because its facilities made possible the more rapid laying of lines than the heavier equipment of the commercial type telegraph of the day permitted (very effective commercial type telegraph was in fact provided for the Federal armies throughout the Civil War by the Military Telegraph organization, a civilian outfit under Quartermaster officers). Just what contributions toward the field telegraph were made by the Signal Officer Myer, and what was contributed by the civilian engineer Rogers, cannot now be determined with any certainty. Presumably, in the pattern of all subsequent cooperation between military officers and civilian scientists and engineers, Maj. Myer provided the hard practical needs of soldiers in the field and Rogers the technical aspects and possibilities known to him in the science of electric telegraphy.

By the end of September 1861, Rogers was writing to Maj. Myer that "the double reel for the flying field telegraph will be ready in 3 weeks." The wire was to be copper conductor, "carefully drawn and annealed to gain additional strength." Wire weighing 85 pounds to the mile he believed would suffice. This was evidently bare wire, as it was to be supported above ground on insulators fastened to lance poles. "Since you left here," he wrote to Maj. Myer on 30 September, "I have made an improvement in the lance, making the insulation more perfect."

This first flying telegraph train was an adaptation to military needs of the conventional battery-powered Morse telegraph system. It at first used bare wire strung on lightweight lance poles, energized by portable storage batteries. All the components were designed to be as lightweight and durable as they could be made in order to stand up under the hard knocks of field use. The transmitting and receiving instruments did not resemble the commercial articles. The

conventional Morse telegraph sender was by that date the telegraph key; the receiver was the sounder, emitting clicks and clacks. Using these instruments, only skilled operators could rapidly send on the key the "dah-dits" of the Morse code and "read" the staccato chatter of the sounder. In the Civil War, as in all wars, men skilled in specific techniques were hard to discover. Maj. Myer urgently wanted what any officer responsible for executing difficult techniques invariably wants — equipment which is simple and which can be worked by relatively unskilled men. He wanted an electric communications "black box" by means of which any man able to read and write might communicate. And that is just what he and Rogers devised. The instruments they designed for this field telegraph train were plain language indicator devices (Rogers also provided the train with conventional keys and small compact sounders in case of a breakdown of the letter indicators). The letter indicators involved a circular index plate bearing the letters of the alphabet, and an index pointer to turn to each letter as it was transmitted. At the receiving end of the wire line, a similar pointer was actuated by the current so as to indicate the letter which was at that instant being selected by the transmitting operator.

The Army's Signal Officer maintained close contact with Rogers by letters, which are now preserved in the Old Army Section of the National Archives. Occasionally Major Myer also travelled to New York to confer with the engineer and inventor. Maj. Myer made suggestions both about the indicating instruments and about the wire, which Rogers called telegraphic "cordage," a type of insulated wire of his own design. "In compliance with your direction under date of 21st ulto," he wrote to Maj. Myer on 3 November 1861, "I have manufactured the necessary telegraphic cordage for the Field Telegraph for the use of the U. S. signal train." And he added, "The instruments and other appliances will be ready in the course of ten days, when I purpose to make the necessary experiments to which you referred during our last interview in this city."

The inventor (Rogers spoke of the indicating letter instruments as his invention in a letter dated 27 November) doubled also as the manufacturer. As soon as he had built the equipment, he ran preliminary tests. "I have tested some of the instruments today," he wrote on 14 November, "on the wires of the Fire Alarm telegraph, which the Superintendent placed at my disposal for the purpose." The small one-pound pocket sounder which he had designed "worked beautifully" over a 50-mile circuit. The letter indicating instruments needed "some slight alteration." He added, "I wish to make the adjustment as simple as possible, so that your officers will have no trouble working it in the field." Meanwhile, the manufacturer was put under pressure to deliver. Toward the end of November (letter of the 29th) he apologized to Maj. Myer for production delays. "I hope you will bear in mind that the greater part of the apparatus has recently been invented so as to adapt it to the purpose, requiring the making of new patterns, models, etc., which requires time."

By mid-December 1861, this first Army signal train was ready. Rogers gave it a road test — doubtless the earliest field test of any U. S. Army electric communications equipment. "I took the instruments *over a rough road 10 miles yesterday*," he wrote on 16 December, triumphantly underlining his words, "and they are now in first rate working order after the test." At the turn of 1861-62, this original signal train, equipped with batteries and letter indicators (also with keys and sounders as standby equipment), was delivered to the Army and to its Signal Corps headquarters in Washington.

Early in 1862, three officers, constituting a Signal Corps Board of Inspection, looked over the train and made a long report dated 25 February. They inspected the train at the Signal Camp of Instruction, which was located on Red Hill near the present intersection of Massachusetts and Wisconsin Avenues in Washington, D.C. They noted that some of the cordage coiled on the wagon reels was copper conductor insulated by a layer of gutta percha and plaited, that is, covered over with a plaited sleeving of hemp thread to protect the wire from abrasion. There were lance poles for "air lines" when bare wire might be used. And there were portable voltaic batteries especially designed against spillage of their corrosive content. The Board reported the carriage and wire reels "will require some modifications." But on the whole the train proved effective. The officers laid out two miles of the wire and noted with satisfaction both that it transmitted "the galvanic current *uninterruptedly*" (their underlining) and that it "suffered no injury even from the passage of heavily laden wagons over it." This last hazard presents, as every Signal officer well knows, one of the severest maintenance problems today. Tracked and wheeled vehicles of every description, whenever they run off the main route, which is often, tangle with communication lines alongside and chew up the wires and cables.

At this point in the development of the Army's first telegraph train, the Beardslee device made its appearance. George W. Beardslee, a New York inventor, had patented in 1859 an efficient magneto-electric generator, which put out considerable current upon the rotation of magnets turned by a hand crank. Rogers had taken note of this generator. He brought one to the Red Hill Signal Camp and he tried substituting it in place of the storage batteries. It seemed to work well. "Since the re-

port of the Board," Rogers wrote to Maj. Myer on 23 March 1862, "the undersigned has successfully applied to the train at the signal camp, the Magneto Electric Machine to work the letter indicating telegraph, thereby dispensing with the galvanic battery and rendering the apparatus more *simple*, portable and efficient in the field." He underlined *simple*. Not only were the batteries at best quite heavy, but the proper maintenance of their acid electrolyte presented a large problem to an unskilled soldier. Almost immediately the officers and inventors perceived that they could combine in a single box Roger's letter indicator instrument and Beardslee's generator. Thus was developed the Beardslee magneto-electric telegraph machine.

By the spring of 1862, the Army of the Potomac was off to the James River and the ill-fated Peninsular Campaign against Richmond. Army's

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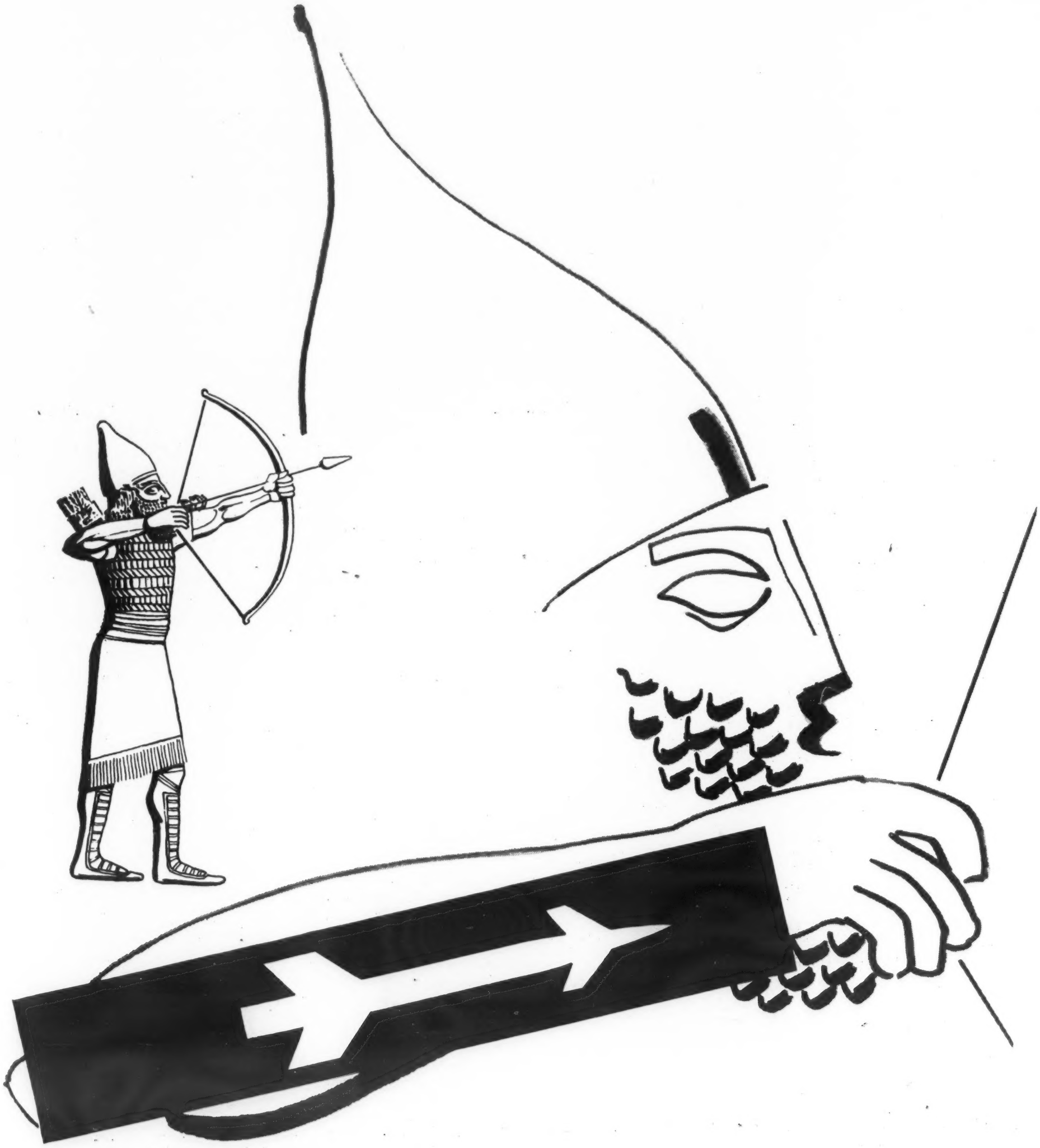

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single field telegraph train went too and there soon received several of the new Beardslee magneto-electric telegraph boxes. Writing on 26 April "in camp near Fortress Monroe," Rogers informed Maj. Myer that he had four of the new instruments. He added in a postscript, "Mr. Beardslee the manufacturer of the new machines proposes to visit Fortress Monroe next week for the purpose of exhibiting the machines . . . Therefore please write me and advise me where to find you." The next sentence in this letter—"He also expects to use them from Lowe's balloon" (Sept., 1957, SIGNAL, p. 26)—indicates that Beardslee was an imaginative man with high hopes for his telegraph. The civilians of the Military Telegraph organization that provided all long-range electric telegraph to the Federal Army had successfully run their wire up the anchoring cable to the balloon basket and had operated in that lofty position.

The Beardslee telegraph machine, thus introduced into the Signal Corps' train in the Spring of 1862, won Maj. Myer's enthusiastic support. "I am satisfied with my trials of the instruments," he wrote on 5 July 1862. His satisfaction was supported by Rogers, who had urged the Chief Signal Officer in a letter dated 29 June 1862 to approve a complete train which Beardslee now proposed to manufacture, equipped with two magneto-electric instruments (which Beardslee proceeded to patent), with five miles of rubber insulated wire and 200 lance poles (all at the price of $2500). "We are anxious," wrote Rogers, "to place a new train in the field based on experiences we have recently gained with the experimental train you now have before Richmond." In one of his last letters to Maj. Myer (5 Oct. in the National Archives file), Rogers having undertaken to examine the first train which the Beardslee Company built, gave it his full approval, saying "for military purposes the 'telegraph' of Mr. Beardslee has decided advantages over all other systems of electric telegraph with which I am familiar." He also recommended to Maj. Myer the youthful son of the inventor, Frederick E. Beardslee, for an Army commission in order to take charge of the train in the Signal Corps.

This new train and its instruments first experienced combat use during the fighting around Fredericksburg in December 1862. The equipment performed sufficiently well so that Maj. Myer won from the Secretary of War an order for a number of

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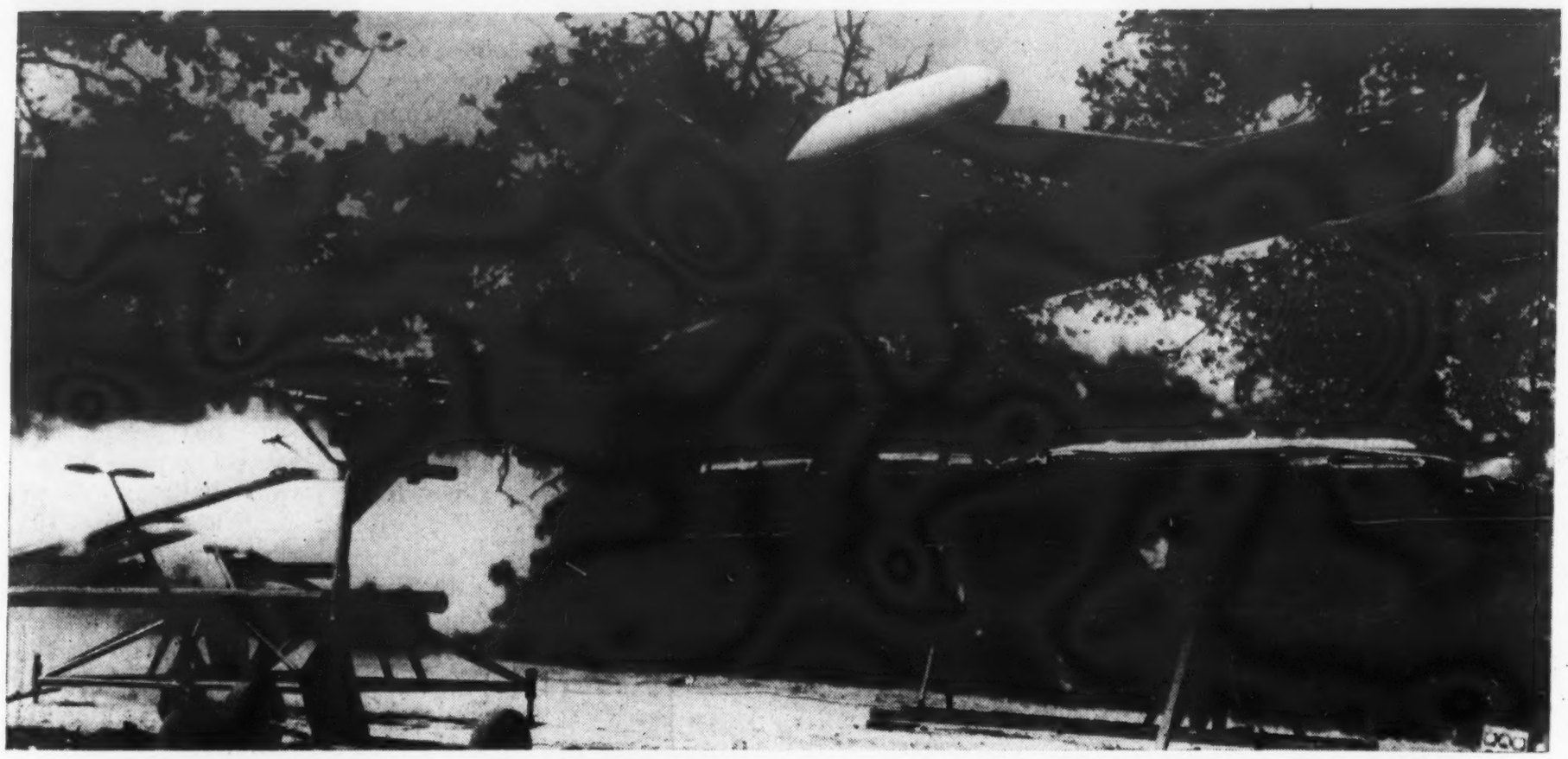

figure 1: Pilotless drone

SURVEILLANCE PHOTOGRAPHY

figure 2

a fly by night

WHILE ADVANCES IN missiles and space technology have caused startling changes in the character of todays warfare, they have underscored with new emphasis the importance of good surveillance. More than ever, tactical Army commanders need to be able to obtain a current and accurate picture of the combat situation in their immediate and surrounding areas. In the battle environment of today's crisp pentomic Army formations, of tremendously increased firepower, of dispersal and independent and fast moving actions, commanders must have quick, dependable means of "seeing across" an erratically defined line-of-resistance fence to see what the enemy is doing and how he is disposed.

Among various means of combat surveillance, photography has long been a primary way of "projecting" the commander's eyes into the enemy area. During WW II about 90 per cent of our intelligence was derived from aerial photographs. This means of surveillance—elevating a camera over the enemy and his areas—assumes more vital significance for future battle operations. Efforts are being made to extend radically its tactical dimensions of performance.

New developments in photographic surveillance by the Army Signal Corps. in conjunction with industry, offer a promising way of increasing its tactical capabilities toward this objective.

In working to provide a system for improved surveillance through aerial photography, the Army considered drone aircraft as natural adjuncts to manned photographic planes for the camera platform.

A system for night photographic surveillance had to evolve from an ultimate solution that offered maximum safety to personnel. Drones had already shown their value for daylight employment and their capability for carrying sensing means. They did not need to carry precious human cargo. And their cost, in comparison to manned aircraft, was considerably less.

Tactical facts which made their night-time use attractive as a camera platform were their relatively small size and target potential, the speed at which they could be made to fly, the low altitudes at which they could be flown, and their operation without need of a landing or take-off strip.

To provide surveillance capabilities for photographic purposes during the hours of darkness, the United States Army Signal Research and Development Laboratory, together with industry, developed a night photographic camera system which could be used in pilotless drones or Army aircraft. This improved system makes possible night photo surveillance of enemy areas. It is capable of giving

commanders accurate, low-level aerial photographs with a high degree of intelligence of the terrain under surveillance. The information gathered from the pictures can be used by small tactical unit commanders or sent to trained photo interpreters for evaluation at higher echelons.

The night aerial photographic system can use Army aircraft or the pilotless drones being developed by the Army, such as the RP-71 shown in Figure 1. This drone—built by the Radioplane Company—is a radio controlled craft which has a flight range of 200 miles. In it, night photographs can be taken at altitudes from 750 to 3000 feet and at speeds up to 200 miles an hour. Flying low-level at night and presenting an essentially small target, it would be difficult to shoot down.

Night Reconnaissance

Night photographs are taken with cameras developed for this purpose which can be carried in Army aircraft or drones. The KA 28 camera. built by the Fairchild Camera and Instrument Corporation under Signal Corps contract in accordance with Signal Research and Development Laboratory technical requirements, is capable of taking fourteen 4½ by 4½-inch format exposures within 30 seconds. Integral light for each shot is at least 300,000 candle power seconds. Night reconnaissance flights of ten miles with the camera can be done in six minutes and will provide photographic coverage of an area strip five miles long and a half mile wide. The film can be brought to the processing-printing station for fast production and distribution to cognizant tactical commanders.

The weight of the camera was kept to a minimum so that it would not adversely affect flight characteristics of the drones or be excessively heavy for Army aircraft. The camera weight, including film load, was held to fifteen pounds. The KA-28 camera's focal length is six inches and it has a f/2.5 lens aperture. In this particular model a solenoid capping type shutter is used.

When used in aircraft or drones, for the higher speeds and altitudes, Image Motion Compensation (IMC) is required to eliminate photographic blur. IMC refers to the movement imparted to the film to compensate for the motion and the direction of flight of the drone aircraft during exposures. It is accomplished in the KA-28 by a drag-link mechanism acting on the film transport.

The camera is mounted on vibration isolators when installed in a drone. The entire system is built ruggedly enough to accept the shocks normally encountered in aircraft take-off, flight and landing as well as those in launching and recovery of drones. The KA-28 camera can withstand the landing effect that is equivalent to being dropped from a one-story building.

There are seven cartridges for each ejector and fourteen cartridges for the drone. When the camera is carried by the RP-71, the position of the ejector in relation to the drone can be seen in Figure 2. Cartridge firing is camera-controlled through a stepping relay. The cartridges themselves are ejected at such a trail angle that light reflection in the lens is prevented. Their pattern with respect to the aircraft occurs in such a way that their illumination does not fix the position of the drone. The total weight of the two ejectors and relay is seven pounds. The photoflash cartridge ejector was designed by the Armament Division of the Universal Match Corporation for the Army.

Camera action can be initiated automatically on radio command. The shutter opens and the film cycling begins. The cycling rate is 0.16 cycles a second for the high altitude gear combination, and 0.65 cycles a second for the low altitude arrangement. The film transport mechanism is driven by a 28-volt D.C. motor. A one-revolution-per-cycle shaft in the camera actuates a micro-switch which pulses the cartridge ejector. The fuse burning time of the cartridge is one second, and duration of the flash occurs during the IMC of the camera cycle.

The KA-28 camera will continue to take pictures by ejecting one cartridge for each exposure until all fourteen are expended. Power to the camera then shuts off and the capping shutter closes.

When the Army aircraft returns or the drone is recovered, the exposed film is readily taken out and brought to the printing-processing facilities. Figure 3 illustrates a night aerial photograph taken with this camera.

Valuable Role

Tactical night surveillance photography can play a prolific role in gathering accurate military data on the nature of the terrain, details of enemy fortifications and troops, launching sites, and his rolling stock of trucks and armor. Well-defined and current photographs of the enemy area and activitv are valuable tools in intelligence and for the combat commanders of today's dynamic Army. The fast pace of tomorrow's warfare and the mobility which must characterize the successful combat formations and their firepower make all quick and reliable means of monitoring the enemy of paramount importance.

figure 3

This article was prepared for SIGNAL by **Anthony B. Orefice**, Photographic Engineer, and **Abraham Schwartz**, Photographic Scientist, Photographic Branch, Components Department, U.S. Army Signal Research and Development Laboratory, Fort Monmouth, New Jersey. The authors wish to thank D. L. Castellini and C. Orlando for their guidance and Pvt. Milton S. Mery for his assistance.

Field Telegraph

(Continued from Page 31)

trains, the order being placed with the Beardslee Magneto-Electric Company early in 1863. By 17 April, production was well under way. On that day, the Company informed the Signal Corps that it had just sent three trains to the Army of the Cumberland, making "nine trains delivered upon the Secr'y of War's order for 15 trains." By May, the Company felt so exuberant over their contributions to the war effort that they undertook to print on their letter heads a double picture illustrating "Geo. W. Beardslee's Military Telegraph at the Battle of Fredericksburg." In a letter dated 12 May, 1863, after some words about the omission of Signal Corps mention in the picture captions, the Company informed Maj. Myer that he must place equipment orders well before his need if he hoped to get delivery on time. He must, for example, order wire at least a month ahead, "as it requires some time to manufacture it." Maj. Myers was told, too, that his new wagon trains on order were being held up on a point of construction. "We are now waiting to hear from you what style of wagons you want for the twenty trains last ordered, whether with springs or without."

Trouble & Improvements

By now Beardslee magneto-electric telegraph instruments were being built in some quantity since each train required at least two. And like most new electrical military developments, the sets were not without "bugs." As early as March 1863 Frederick Beardslee, signing as "Capt & ASO [Acting Signal Officer] in charge of Sig Teleg Detchmt," had returned from the field one set because it was "weak." He wrote to Maj. Myer: "The cause of its weakness is not, I think, the loss of power in the magnet but some defect in some of the spools." More sets went bad. The mechanism rotating the magnets and controlling the impulses of the current wore out or became magnetized, affecting adversely the performance of the device. The Company examined sets returned for repair and made improvements, replacing the steel of the rachet wheel with German silver. On 8 June 1863, the Company reported the matter to Maj. Myer—by this time a Colonel—in his headquarters at 158 F Street. The building, little changed, still stands at 1905 F St., N.W., Washington, and is now a part of The American University downtown plant. Beardslee's secretary, Mr. Schramm, explained the improvements as follows:

> We have until recently made both the pallets and rachet wheels of all the instruments of hardened steel, of the greatest obtainable density, hoping by that means to secure the greatest strength and durability to these parts. Experience however has taught us that the rachet wheels and pallets so constructed are liable to become magnetic, and cling to each other, to the detriment of the working of the instrument, and also, that the greater wear of the pallets (having to bear 15 strokes each to one revolution of the needle shafts while each cog receives only one stroke, during the same time) soon affected them. We have therefore concluded to take different metals of different degrees of density for each — the pallets and the ratchet wheels— making the pallets of hardened steel and the rachet wheel of German silver, it being a recognized fact that the friction and wear is less under the same circumstances with metals of different degrees of density . . . German silver presents the additional advantage of being non-magnetic, so as to secure us against any apprehensions on that score.

All major maintenance had to be done by the manufacturer, naturally, in those sets where substitution of the improved German silver ratchet wheel was needed. On 14 August, the Company informed Col. Myer it had shipped instrument no. 1 to the Signal Officer in the Dept. of the South, at Hilton Head, South Carolina. Three others, nos. 4, 5 and 6, returned for repair, were now restored to good condition and awaited Col. Myer's directions as to where they should be shipped. On 21 August, Capt. Frederick Beardslee sent to the Washington Signal Office five more sets. No. 48 had suffered damage and burnt out spools from a lightning stroke on the wire line. The other four had become "worn in the pallet & rachet wheels by constant use." Young Capt. Beardslee recommended that the Signal Corps headquarters return the sets to New York for repair. Meanwhile set no. 1 was again returned from Hilton Head, S.C., to the factory for repair. The trouble this time, the Company reported to Col. Myer, was that too much oil had been used to lubricate the set. Then, as much sand had blown into the gears, it had become agglutinated with the oil and had jammed the works. In this letter, one of the last regarding the sets, the Company recognized that it would be well to design the instruments with a view to easy maintenance in the field. "Directions have been given to devise if possible some mode of construction by which the rachet wheel and pallets may be readily replaced when worn out, without sending them to New York." Meanwhile, the Company provided the Signal Corps with suitable maintenance and tool kits (solder, rubber cement, rubber sleeves, etc.) together with "four hundred pamphlets containing directions for the practical working of Geo. W. Beardslee's Magneto-Electric Signal Telegraphs."

One defect never fully overcome despite optimistic promises by the developer and manufacturer was the tendency of the index pointer to stop on a letter other than the one intended, the rotary momentum causing the pointer to overshoot the desired letter. In the autumn of 1863, Col. Myer therefore took steps to replace the letter indicator telegraph instruments with Morse keys and sounders. That meant that he would have to acquire Morse code operators, rare specialists. He advertised for them, thereby incurring the wrath of the Military Telegraph organization and the displeasure of their strong supporter, the Secretary of War himself. Suddenly and summarily, Secretary Stanton ordered that the field telegraph equipment of the Signal Corps be turned over to the Military Telegraphers, who promptly shelved it for the duration of the Civil War.

Until this temporary set-back in the U. S. Army's field telegraph effort, some thirty "flying" trains had been built. The Beardslee Magneto-Electric Company produced over sixty sets of its dial indicator telegraph instruments. In Major Myer and in the civilian engineers and inventors Rogers and Beardslee, the military needs of that far-off day and the "know-how" of the infant technology of electrical communications met. Together the three men pioneered a pathway in cooperative endeavor toward the development of military communications equipment, a cooperative endeavor so huge in scale today that it would astonish them. Yet in many of the development processes and problems of today Maj. Myer and Messers. Rogers and Beardslee would recognize not a few points of similarity to their own experiences nearly a hundred years ago.

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TRAINING AGAINST AIR ATTACK

by
Capt. Robert L. Hogan
Instructor
Radar Electronics
Air Defense School

"INITIAL PLOT! TRAINING track, two-five. Alpha George, one-nine-three-six. Three unknowns! High. Time—fifteen-oh-two."

This warning order is given in a low voice by a radar operator peering into a radarscope. A rotating strobe of light has brought out three small, closely-grouped blips, or smears of light against its blue-green glow. The operator had been watching the blips for a few seconds prior to speaking. It took several rotations of the strobe to bring out the faint, shadowy shift of each light smear to tell the experienced operator they were being made by a rapidly moving object many miles away. Even while giving his low-toned order he places an electronic indicator over the first blip and presses the button to alert the three tracking operators.

At the same instant, this electronic order automatically slews the track radar in azimuth and elevation so that its pencil-like radar beam is aimed in the general direction of the target. The three tracking operators manually operate their controls to move the radar in azimuth, elevation and range. The target is still many miles off, well beyond the visual sight of any of the operators. Their sole mission at this time is to recognize a small pulse of light as it appears along a thin luminous baseline across the center of three small scopes. Bringing this small pulse of light into the center of each scope calls on the very optimum of skill, experience and training of each of the operators. Their smooth and concurrent movements blend together in such a manner that the radar beam seems to be merely the extension of one. The suspense culminates in a single low command "Automatic." The track radar electronically locks on the target and will now cling to it throughout any evasive maneuver. It is only after the automatic stage is reached that the track radar can generate the range, altitude and velocity information into a computer in order to evaluate the intentions of the unknown targets.

Are they hostile or friendly?

Another operator, sitting before electronic identification equipment, is directed to query the target and watch for the coded pulse on his scope and identify the target as friendly. No answer! They are hostile!

Red alert! A siren screams its warning and men double-time to their battle station. Essential checks of all firing equipment are made. Small lights appear in consecutive order with the status of battle readiness. The missiles are poised and ready. Less than five minutes has elapsed since the first words. "Initial plot—"

The fire control officer begins his staccato count-down. He presses his fire switch. Missile away!

All eyes turn to the plotting board as the pens draw their irresistible thin black lines which represent the position of the missile and target in space. Another board nearby gives continuous information as to the relative converging velocities of target and missile. The burst point is reached! Radar operators peer at their scopes for the telltale effects of a kill. It is a kill! One hostile down, two to go. The procedure is repeated quickly, efficiently and effectively.

Here is represented realistic battle training for our on-site NIKE-AJAX battalions. This is the sort of training which will be given when the new and long awaited training device, 15D2, Radar Target and Effects Simulator, enters the field. Production dates have recently been firmed which will assure the 15D2 of being shipped to the first scheduled on-site battalions some time in August, 1958. This device is manufactured by the Martin Company of Orlando, Florida.

What will the 15D2 do for the SAM Battalion Commander in training his fire units?

The 15D2 is a trailer-mounted device which will move into a site position, connect up to the existing fire control system and inject several types of radar targets and effects into the attached radar and fire control vans. It does not have its own prime mover, or a source of 400 cycle, 3 phase power, and will depend on these two items from the units to which it is assigned.

It will inject up to six simultaneous targets into the acquisition receiver system for realistic presentation on the PPI. Each target will be movable anywhere in range and azimuth to a maximum range of 200,000 yards with velocities up to 2,000 knots. Curvilinear and diving courses can be programmed into each target. In addition, each target produces proper phasing, both in notation and monopulse modes, which will enable the track radar to lock-on and autotrack the target.

All target are displayed on a 15-inch monitor scope within 15D2 for proper timing and appearance of each target before it is injected into the associated fire control system. Current IFF signal codes can be applied which seem to emanate from any desired target.

The complete fire control team will be trained. Upon activation of the FIRE signal at the BCC, the 15D2 will cause a representation of a NIKE-AJAX missile trajectory to appear in the missile fire control system. It will respond to computer commands as if it were the real missile.

Nearly all forms of electronic and reflective jamming effects can be applied to the associated radar at any time during training to provide the most important experience of all.

The Air Defense School is now in process of formulating an intensive maintenance course to be given at about three-month intervals to seselected students. The essential prerequisite needed for this course is the successful completion of one of the three radar courses given at the Air Defense School on either NIKE-AJAX, M33 or M38 radar fire control systems. The length of time left to serve upon graduation from the 15D2 course must exceed 12 months.

A short review of basic electronic principles consisting of approximately forty hours will be given to those students who are entering the maintenance course.

The 15D2 is a training course. Certain key personnel are needed to gain effective use from the 15D2.

The Instructor or senior technician: He should possess the grade of E6 or E7, He will be expected to organize and coordinate the 15D2 into the operational training program of a missile battalion and to direct the activities of the manipulators and maintenance technician in the employment of the 15D2 at each battery site. He will assist the missile battalion commander in his training program to achieve effective and efficient fire units.

The maintenance technician: He should possess the grade of E5 or E6. He will be mainly responsible for the proper operation of the 15D2 during its training mission and direct preventive maintenance procedures and adjustments to keep the device in proper operating condition. He is expected to have the knowledge and skill to adjust and repair the 15D2. He must be able to efficiently train manipulators for the device.

The device manipulator has been given this title to identify him in relation to the operators on the fire control equipment. He should possess a grade ranging from E3 through E5. These men will be expected to possess the necessary skills to manipulate all the controls on the device needed to produce realistic target and interference effects in such a manner as to cause the 15D2 to provide the maximum amount of radar operator training possible.

It is planned that the 15D2 maintenance course will provide the technician with a concise and thorough knowledge of the operation, adjustment and repair of the system. He will be completely grounded in the capabilities and limitations of the device as a training instrument. This will be accomplished by a combination of theoretical troubleshooting techniques and practical application on the system. In addition, he will be trained in all the operational aspects and skills of the system as it will be used in the training program. Sufficient background information will be provided him to adequately train selected on-site personnel in the skill of device manipulation.

It is anticipated the first school maintenance course on the 15D2 will commence about the first week in August 1958. Due to the low ratio of 15D2 training devices to actual fire units in the field, and the expected low production rate of the devices, it is planned to keep student quotas for each class in the vicinity of 35 students, beginning every ten weeks. Further information about this course will be available soon after its formal announcement from CONARC.

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Science and the Signal Corps

(Continued from Page 9)

During each missile countdown, balloons are launched carrying tiny, lightweight radiosondes to measure weather conditions and radio them back from the upper atmosphere to computing receivers. The radiosondes, receivers and entire balloon-borne system are products of Army Signal Corps research and development, which also pioneered in rocket exploration of upper atmosphere conditions.

When a missile is fired, an orderly jungle of tiny electronic components is activated in microseconds. Numerous chemical batteries, some no bigger than a nickel, supply power to essential radios, beacons and control elements. The Army Signal Corps has battery responsibility for all Army and Air Force missiles, and acts in a consulting capacity for Navy "birds."

Constant power for satellite radios is made possible by an ingenious Army Signal Corps combination of solar converters, or "sun batteries" and miniature chemical storage batteries. Application of electrical power to the various needs of missiles and satellites called for more scientific advances in design and construction of other power converters similar to that in the Explorer. Diodes were inserted in circuits to prevent undue drain or back-up of power between chemical and solar cells. All of these problems were taken in stride by Army Signal Corps scientists, engineers and technicians.

Every missile contains hundreds of ultra-small components — transistors, tubes, diodes, capacitors, resistors, and so on. Satellites contain dozens. These are bread and butter to the Army Signal Corps. Scarcely an electronic component in existence today does not owe much to Army Signal Corps science, both in basic research and practical application.

Not only did Army Signal Corps research do much toward development, but its scientific advances have contributed materially to the miniaturization and sub-miniaturization programs that made components small and light enough for missiles and satellites. Rugged and reliable pinhead parts, and efficient space utilization to fit them into the smallest possible areas are as essential to a small field radio or a portable radar as to a space vehicle.

To list all recent Army Signal Corps scientific achievements here would be impossible. Only a few have been touched. Radar, for instance, has hardly been mentioned, but American radar is the brainchild of Col. William R. Blair, who recently received the basic patent on pulse-echo radar for work he did while commanding the Army Signal Research and Development Laboratory. The Army Signal Corps developed the famous Diana, first radar to bounce a signal from the moon. Aside from Diana's exploration of radio propagation phenomena, one of its present uses, incidentally, is for Minitrack calibration.

Since there is scarcely a field of science today that is not dependent on electronics, there is little science that does not benefit by Army Signal Corps scientific achievement.

The rapid advance of science will not let the Army Signal Corps rest on its laurels, however. Right now Army Signal Corps personnel, both military and civilian, are working on solutions to the many problem areas which confront us. It is only through such constant effort that the Army Signal Corps can do its share to maintain our nation's security.

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photoprogress

by FRANK SMITH
SIGNAL PHOTO EDITOR

A New Development in Photoflash Batteries

Photographers who are 'plagued' with the shortcomings of ordinary photoflash batteries will be pleased to hear of one of the newest developments in this field, a long-life, high-drain alkaline type cell known as the Eveready "Energizer" manufactured by National Carbon Co., a division of Union Carbide and Carbon Corp., 30 E. 42nd St., New York City.

The battery, which is claimed to give as much as ten times the service previously obtained from standard carbon-zinc dry batteries of the same sizes, is leak-proof and uses a potassium hydroxide electrolyte, a zinc negative pole and a manganese dioxide depolarizer. Hermetically sealed in a steel case, the operating voltage is 1.5-1.6 volts at 10-ampere hours. A maximum short circuit current of 20-25 amperes is obtainable.

One of the interesting features of the battery is its operating temperatures which are -40 degrees F to 200 degrees F. In addition to its use in photoflash work, the battery is suitable for use in portable radios, phonographs, tape recorders and in portable electronic flash units and portable still and motion picture cameras.

The main advantage in low-drain work such as conventional photoflash is a much longer life. In high-drain work such as electronic flash, the operating efficiency is considerably higher.

List price of the D-size E-94 is 50c. The D-size E-95 is 75c.

New Stick Light for Enlargers

Newest product of the General Electric Company's Photo Lamp Department is the "stick" light bulb. Only three-eighths of an inch high in its operating position, the new bulb will help reduce the size of photographic darkroom equipment like enlargers and printers and will improve the performance of several other photographic equipments including copying devices and some types of projectors. It is shown here compared with a standard 75-watt G-E photo enlarger light bulb. In use, the new tubular light bulbs lie side by side. The resulting flat plane of light will produce a more uniform brightness over the entire negative than is possible with other light sources, according to G-E photolamp engineers. Made of clear glass, the new 100-watt bulb operates on 110 volts, has a cap base and an expected life of ten hours.

Automatic Caption Writer for Aerial Photos

An automatic caption writer, known as the Digital Data Recording Device, has been developed by Federal Telecommunication Laboratories, research division of the International Telephone and Telegraph Corp. for use by the Air Force in aerial photography.

The Digital Data Recording Device records, in code, the location, speed, altitude and other pertinent data directly on the photographic film as the camera plane speeds over its target.

The IT&T equipment, developed for the Wright Air Development Center, Air Research and Development Command, USAF, is the first to record the data and the target-photograph on the same film. Tailor-made to meet the demands of jet-age aerial photography, the device eliminates the laborious recordings by hand of the plane's position, or the filming of the plane's instrument panel by a separate camera.

With the new equipment, information from the plane's instruments appears in a scientific shorthand on a one-inch cathode ray tube located in the aerial camera's field of vision. As the camera turns, an automatic recording of the digital data is made on an area no larger than the head of a tack.

Printing on the film is another first in aerial reconnaissance. With no ink known that would adhere to celluloid, IT&T scientists developed a printer tape coated with a gold-leaf that prints coded information directly on the film. For permanence, the gold-leaf is sprayed with a plastic coating.

High Flying Eyes—Photographic "Flying Saucer"

Sooner or later it had to come — in fact, it is here — a photographic flying saucer that flies piggy back on the wing of an airplane or guided missile where it can record photographically the accuracy of missiles or obtain other data vital to the nation's speeded-up missile program.

Called the "Fotodome," it is a development of the Traid Corp., Encino, Calif.

Films taken by the automatic camera system reveal missile performance from the target's point of view.

One of several versions of the Fotodome consists of a circular aluminum base plate 24 inches in diameter, covered by a clear plastic dome which is optically ground and polished. Two 16mm motion picture cameras mounted inside the dome obtain an undistorted view in any direction. The cameras figure out their own exposures by means of automatic controls which constantly adjust lens diaphragms to compensate for changes in light conditions.

Supersonic Lens

As if the flying saucer was not enough, the company has been appointed distributor of a supersonic lens which is designed to withstand heat friction, shock and vibration at airborne speeds of Mach 4 and higher. The new lens, a product of Zoomar, Inc., Glen Cove, N.Y., will be used in high-speed fighters, bombers, drones, guided or ballistic missiles and in upper-air research craft.

Having extremely low aerodynamic drag, the lens does not heat excessively at high speed. (Ordinary glass becomes red hot between Mach 1 and 2 with the result that pictures cannot be taken at these speeds.)

The unit is a combination of a periscope and an anamorphic lens, and projects only slightly into the airstream. It serves as a periscope to a 16mm camera, providing a 30-degree view. Focal length is 22 mm and speed is f/3.5. It may be used at distances of 3 to 9 inches from the camera, and allows up to 90 degrees angle turn from the camera.

The lens is small and adaptable to wings with thin leading edges. It is made up of fused quartz and silicon and resists temperatures up to 800 degrees F. Higher temperature resistance is available in special models. The iris diaphragm operates under loads up to 25 G. Waterhouse stops are available for higher acceleration loads.

There you have it! Farther, faster and higher into the realm of the unknown—and photography will picture it for us!

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Full Color Pictures Produced From Ordinary-Appearing Black-and-White Slides

Dr. William Glenn, a physicist at the General Electric Research Laboratory, Schenectady, N.Y., at a meeting of the Optical Society of America in March 1958 described a new technique for recording "color information" in tiny ripples on a clear gelatin film. In a demonstration, using a colorless, transparent slide, Dr. Glenn produced a full-color photograph by projecting the slide on a screen.

The ripples in the film serve as a diffraction-grating system, and a special projector is used to "translate" the diffraction patterns — overlapping series of light waves — so that brilliant primary colors are projected on the screen at the same time.

By placing a special mask in front of the film in an ordinary camera, color photographs can be taken directly on black-and-white negative materials.

An unusual aspect of the system is that it makes possible a full-color picture produced by two primary colors, one fixed and one variable, instead of the usual system of three fixed primaries. Dr. Glenn showed how the "one-fixed-and-one-variable" method actually reproduces a greater part of the visible spectrum than the ordinary three-primary system.

The General Electric scientist said the new color projection technique may have eventual importance in color TV for both home and theater applications.

General Electric officials emphasized, however, that Dr. Glenn's presentation was a "technical paper describing a laboratory achievement and definitely not a product announcement."

Brief-Case Photocopier

Short-cut photo copying of anything drawn, printed or written, even in bound books and magazines, is now possible with a compact brief-case type photocopy machine, the Contoura Portable.

Equipped with a patented plastic air cushion which follows page contours right to the margins, it will produce crisp, black photo-exact copies in 30 seconds, including work done with paints, inks, and crayons.

The photocopier can be used to make films for visual aids projection, make transparencies for Diazo machines or negative film in 8 seconds, for offset printing plates.

The copier can be conveniently carried to libraries or office for on-the-spot copying. It is easy to operate since the same setting copies all material. Price per page for copying by Contoura is 8½ cents.

A Magna model of the copier is also available for large scale copying.

Prices range from $137.50 to $420.00. Contoura photocopiers are manufactured by F. G. Ludwig, Inc., Old Saybrook, Conn.

New Bell and Howell Angenieux Zoom Lens for 16mm Movie Cameras

A new lens that enables the amateur movie maker to "zoom in" on his subject at will, has been introduced by Bell and Howell, 7100 McCormick Rd., Chicago 45, Ill.

The lens, which fits all B&H 16mm cameras (except the electric eye models) and most other standard C-mount cameras, has a maximum lens opening of f/2.2 and is claimed to be the fastest zoom lens on the market having a 4-to-1 range of focal length variation.

Turning the zoom handle changes the focal length of the lens from wide-angle (17mm) to normal, to telephoto (68mm), affording the versatility of many lenses in one. It also permits the movie maker to keep right on shooting while switching from closeups to long shots. The four-to-one ratio in focal length represents a 16-time change in the area viewed by the lens. At the maximum telephoto setting, the subject image is 2.7 times larger than the image obtained with a normal lens.

The lens is equipped with its own reflex viewfinder, which shows exactly what the lens sees at all times.

No exposure increase is required when the focal length is increased, a significant development in optical design.

A ring at the rear of the viewfinder opens and closes the eyepiece shutter, preventing stray light from entering the optical system when the finder is not being used for viewing. An eye-cup shuts out distracting light from the user's vision. It is removable for the convenience of those wearing glasses.

The lens measures only 4½ inches in length and is unusually light in weight for a zoom lens. It was designed by Pierre Angenieux, one of the world's foremost optical designers, and is made to Bell and Howell specifications at the Angenieux factory in France.

Retail price of the Bell and Howell-Angenieux zoom lens, including a black cowhide case, is $429.95.

New Photosensitive Materials

The world's flattest commercially-produced photographic plate, called the Kodak Super Aerographic Positive Plate, rules out the previously vexing factor of glass plate flatness in the exacting business of aerial mapping. With a surface flatness tolerance that is 35 times closer than the normal aerographic plate tolerance of .007 inches per inch, the plates will bring unusual accuracy to the task of cutting mountains down to size via aerial mapping. The new plates will backstop the photogrammetric process in the final transparency-making stage of topographic mapping. Used to make positive glass plate transparencies of the original aerial negative, the plates will afford photogrammetrists a measure of Euclidian accuracy when used in a stereo projector to display the lay of the land in 3-D.

Kodak engineers report that the plate is so flat that no departure more than .00002" (150 times thinner than a human hair) in distance could be detected from the plane of any one-inch diameter circle "drawn" on the plate's emulsion bearing surface.

It may be of interest to know that the new plates are tested for flatness via a technique propounded by Sir Isaac Newton close to 300 years ago. The technique involves the use of light rays to measure the space between two surfaces, as indicated by light wave interference patterns. From the number of alternating dark and light bands visible when the test sample is placed over an optical flat—a specially-prepared quartz glass which is flat to a tolerance of .000001, and viewed under monochromatic light—the engineer can determine the departure of the sample from a presumably perfect plane.

Another news item which is sure to interest 35mm color enthusiasts everywhere is the announcement by Kodak that the popular dual-purpose Kodacolor film, which may be used outdoors or in artificial light to make sparkling color prints, is now available for the 35mm camera user in a 20-exposure roll.

Previously available only in roll film sizes, Kodacolor film is a wide latitude, color negative material balanced for picture-taking under daylight or clear flash illumination. Differences produced in the negatives by these types of light are compensated in the printing operation. Thus the photographer can take daylight or flash pictures on the same roll of Kodacolor film.

The film, with an exposure index of 32 for daylight, has a fine grain structure that makes it possible to achieve fine quality enlargements from a 24 x 36mm negative.

Super Anscochrome Tungtsen film, claimed to be the world's fastest indoor color film, is now available in 16mm. 35mm (long length) and 70mm sizes according to a recent announcement by the company. Super Anscochrome's exceptional high-speed (100 with normal processing), coupled with its unique color characteristics, makes it possible to produce satisfactory results under a wide range of light sources from candlelight and household lights to studio photofloods.

The film is stated to be ideal for such professional applications as high-speed motion analysis, data recording, stress studies, available light reportage, portraiture and other uses in the industrial, scientific, military, medical, engineering, news, and other professional fields.

Association affairs

New AFCEA Officers and Directors

During the twelfth National Convention, RAdm. Frederick R. Furth, USN (Ret.), Vice President of International Tel. & Tel. Corp., was elected to a second term as National President of AFCEA. Also elected were: 1st Vice President—Maj. Gen. James D. O'Connell, USA, Army Chief Signal Officer; 2nd Vice President—RAdm. Frank Virden, USN, incoming Director of Naval Communications; 3rd Vice President—Maj. Gen. Howard W. Grant, USAF, incoming Air Force Director of Communications-Electronics; 4th Vice President—John Inwood, District Manager, Los Angeles Western Union Telegraph Co., and 5th Vice President—Benjamin H. Oliver, Jr., Vice President and General Manager, New York Telephone Co., Upstate Area.

Directors elected for regular 4-year terms include B. S. Gilmer, President, Southern Bell Tel. & Tel. Co.; Donald C. Power, President, General Telephone Corp; Joseph E. Heinrich, AT&T Long Lines Dept. (former AFCEA V. P.), and John R. Howland, Dage Television, Thompson Products, Inc., (former AFCEA V.P.).

Also elected to the Board of Directors were: John J. Hanselman, Assistant Vice President, AT&T Co., for a 2-year term, and Henry J. McDonald, Secretary and General Counsel, Kellogg Switchboard & Supply Co., for a 1-year term.

Directors re-elected for a 4-year term include George W. Bailey, Executive Secretary, IRE; Theodore L. Bartlett, RCA; Maj. Gen. Gordon A. Blake, USAF, and Fred E. Moran, Western Union, Boston District Manager.

Those renamed to their respective offices were Capt. Wilfred B. Goulett, USN (Ret,), Executive Vice President; Mrs. Julia B. Godfrey, Secretary, and Ralph L. Walker, Counsel. Thomas B. Jacocks of General Electric Co. was elected Treasurer.

The following new regional vice presidents were named: Region C (South)—W. K. Mosley, Assistant Vice President—public relations, Southern Bell; Region A (Northeast)—G. D. Montgomery, Defense Coordinator, AT&T Long Lines Dept., and Region D (Southwest)—Stephen W. Simpson, Assistant Vice President, Southwest Research Institute.

New Contributing Editor

SIGNAL takes pleasure in announcing the appointment of Mr. T. E. Gootée as contributing editor and permanent member of the staff of the magazine. Long familiar to readers of technical and military publications, Mr. Gootée has been a regular contributor to national magazines, popular and technical. Associated with the Army Signal Corps for the past 17 years and a charter member of AFCEA, Mr. Gootée is at present a member of the Office of the Chief Signal Officer in Washington, where he handles public relations for the Army Signal Corps.

New Group Members

Van Norman Industries, Inc.

AFCEA recently welcomed Van Norman Industries, Inc., Electronics Division, to its group membership. This electronics and electro-mechanical manufacturer is located at 186 Granite Street in Manchester, N. H.

Members of the firm who will be company representatives in AFCEA are: S. K. Lackoff, division president: R. H. Baer, division vice president: F. J. Paolucci, division vice president: A. Axelrod, chief engineer; S. Pincus, chief engineer; Adm. J. J. Clark, (USN. Ret.), assistant to the president; William Gabor, senior project engineer: W. Follin, director field engineer; H. I. Segal, president, and J. L. Lewis, vice president.

Atlas Film Corporation

The oldest commercial film producer in the country today, Atlas Film Corporation, 1111 South Boulevard, Oak Park, Illinois, joined AFCEA in June. This firm, which was established in 1913, is a major producer of motion pictures and sound slidefilms for industry and government.

The company representatives in AFCEA will be: L. P. Mominee, president; A. S. Bradish, vice president—production; F. K. Barber, vice president—sales production; E. Schager, vice president-director of sales; J. C. Bancroft, writer; A. F. Cook, writer: H. Peterson, special effects—color and black and white; J. D. Danielson, director of television; J. L. Herman, public relations films; R. C. Barrett, Washington representative.

AFCEA
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Washington 6, D. C.
Phone: EXecutive 3-3033

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AFCEA Group Members

Communications—Electronics—Photography

Listed below are the firms who are group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

Acme-Danneman Co., Inc.
Admiral Corp.
Aircraft Radio Corp.
Allied Control Co., Inc.
Allied Radio Corp.
American Cable & Radio Corp.
American Electronic Laboratories, Inc.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Radio Relay League
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Amphenol Electronics Corp.
Anaconda Wire & Cable Co.
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Atlas Film Corp.
Atlas Precision Products Co.
Automatic Electric Co.
Automatic Electric Sales Corp.
Automatic Telephone & Electric Co., Ltd.
Autonetics, Division of North American Aviation, Inc.
Barry Controls, Inc.
Bell & Gossett Co.
Bell Telephone Company of Pa.
Bell Telephone Laboratories, Inc.
Bendix Radio Division, Bendix Aviation Corp.
Bliley Electric Co.
Bomac Laboratories, Inc.
British Thomson-Houston Co.. Ltd.
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California Water & Telephone Co.
Cambridge Thermionic Corp.
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Carolina Telephone & Telegraph Co.
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Chesapeake & Potomac Tel. Co.
Cincinnati & Suburban Bell Tel. Co.
Close Associates, Inc.
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Columbia Broadcasting System, Inc.
Contraves Italiana
Convair, Division of General Dynamics Corp.
Cook Electric Co.
Copperweld Steel Co.
Cornell-Dubilier Electric Corp.
A. C. Cossor Ltd.
Craig Systems, Inc.
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Designers for Industry, Inc.
DeVry Technical Institute
Diamond State Telephone Co.
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DuKane Corp.
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Eastman Kodak Co.
Electronic Associates, Inc.
Electronic Communications, Inc.
Elgin Metalformers Corp.
Fairchild Camera & Instrument Corp.
Farnsworth Electronics Co.
Federal Telecommunication Laboratories
Federal Telecommunication Laboratories—West Coast Branch
Federal Telephone & Radio Co.
General Aniline & Film Corp.
General Cable Corp.
General Communications Co.
General Electric Co.
General Telephone Corp.
Gilfillan Bros., Co.
Globe Wireless, Ltd.
Gray Manufacturing Co.
Hallamore Electronics Co.
Haller, Raymond and Brown, Inc.
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Haloid Co.
Hazeltine Electronics Division, Hazeltine Corp.
Heinemann Electric Co.
Hitemp Wires, Inc.
Hoffman Laboratories, Inc.
Hogan Laboratories, Inc.
Hopkins Engineering Co.
Hughes Aircraft Co.
Illinois Bell Telephone Co.
Indiana Bell Telephone Co.
Indiana Steel & Wire Co.
Institute of Radio Engineers
International Business Machines
International Resistance Co.
International Telephone & Telegraph Corp.
Jacobsen Manufacturing Co.
Jansky & Bailey, Inc.
Kellogg Switchboard & Supply Co.
Kleinschmidt Laboratories, Inc.
Koiled Kords, Inc.
Lansdale Tube Co., Division of Philco Corp.
Leich Sales Corp.
Lenkurt Electric Co.
Lewyt Manufacturing Corp.
Lockheed Aircraft Service, Inc.
Machlett Laboratories, Inc.
Magnavox Co.
Marconi's Wireless Telegraph Co. Ltd.
Materiel Telephonique Co.
Michigan Bell Telephone Co.
Montgomery Co., The
Motorola, Inc.
Mountain States Telephone & Telegraph Co.
Mullard Ltd.
Muter Co.
Mycalex Corporation of America
National Co., Inc.
Nelson Technical Enterprises
Nems-Clarke, Inc.
New England Tel. & Tel. Co.
New Jersey Bell Telephone Co.
New York Telephone Co.
North Electric Co.
Northwestern Bell Telephone Co.
Oak Manufacturing Co.
Ohio Bell Telephone Co.
O'Keefe & Merritt Co.
Otis Elevator Co., Electronic Division
Pacific Mercury Television Mfg. Corp.
Pacific Telephone & Telegraph Co.
Packard-Bell Co.
Page Communications Engineers, Inc.
Phelps Dodge Copper Products Corp.
Philco Corp.
Photographic Society of America
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Radio Corporation of America, Defense Electronic Products
RCA Great Britain, Ltd.
Radio Engineering Laboratories, Inc.
Ramo-Wooldridge Corp.
Raytheon Manufacturing Co.
Red Bank Division, Bendix Aviation Corp.
Reeves Instrument Corp.
Rocke International Corp.
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Society of Motion Picture & Television Engineers
Sonotone Corp.
SoundScriber Corp.
Southern Bell Telephone & Telegraph Co.
Southern New England Telephone Co.
Southwestern Bell Telephone Co.
Sperry Gyroscope Co., Division of Sperry Rand Corp.
Sprague Electric Co.
Stackpole Carbon Co.
Standard Telephone & Cables, Ltd.
Stanford Research Institute
Stewart-Warner Corp.
Stoddart Aircraft Radio Co.
Stromberg-Carlson Co., Division of General Dynamics Corp.
Surprenant Mfg. Co.
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Technical Materiel Corp., The
Tele-Dynamics, Inc.
Telephonics Corp.
Teletype Corp.
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Texas Instruments, Inc.
Times Facsimile Corp.
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Transitron Electronic Corp.
Trans-Sonics, Inc.
Triad Transformer Corp.
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United Transformer Co.
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Western Electric Co., Inc.
Western Union Telegraph Co.
Westinghouse Electric Corp.
Weston Electrical Instrument Corp.
Wheelock Signals, Inc.
Wickes Engineering & Construction Co.
Wilcox Electric Co., Inc.
Willard Storage Battery Div., Electric Storage Battery Co.
Wisconsin Telephone Co.
Wollensak Optical Co.
Zenith Radio Corp.

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Chapter News

Arizona—John Atwood of Hughes Aircraft, and a director of AFCEA's Southern California Chapter, was guest speaker at the April meeting.

Arizona

The growing importance of electronics for defense was stressed by Col. John Atwood, USAR, in an address before the chapter's April meeting.

Col. Atwood, a staff member of the Systems Development Laboratories at Hughes Aircraft, Culver City, Calif., said, "No airplane, no ship, no tank, in fact no fighting unit could be sent to battle today without electronics."

He pointed out that today electronics is used not only for communications, but for reconnaissance and fire control. Radar, for example, now gives a fighter pilot both range and location of an enemy plane. With the assistance of an airborne computer the pilot may, by pushing a button, "lock on" the target, and turn the guidance of his plane over to the miracle of electronics. Even the firing of his weapons, in this case rockets, is done automatically at the proper instant.

Atlanta

The chapter's last meeting of the season was held at the Fort McPherson Officers Club on May 13th with 165 members and guests present.

The meeting was opened with an invocation by Russell Huff of Southern Bell Tel. & Tel. Co. President W. B. Bryan then began the meeting by introducing Gerald Ghertner of Cullom and Ghertner Company and commending him for services he has rendered the chapter. Elliott Jackson, Atlanta Director of Civil Defense was also introduced to the gathering. Bill Burnett, membership chairman, gave a brief talk on encouraging membership.

Those seated at the head table were: A. E. Arnold, 1st vice president; Lt. Col. Luther J. Ross, 4th vice president; A. M. Wilson, secretary and treasurer; J. S. Bonner, Civil Defense chairman; Captain N. A. Christensen, house committee chairman; W. G. Burnett, membership chairman; A. J. Cartey, program chairman; H. C. Malone, publicity chairman, and M. S. Butler, reception chairman.

Musical entertainment was provided by the Third Army Special Services Section.

Augusta-Fort Gordon

The chapter held its May meeting at Timmerman's Place on May 15th.

The chapter voted to present a scholarship award of $100, to be applied against college tuition in the fall, to the most deserving high school senior in the local area.

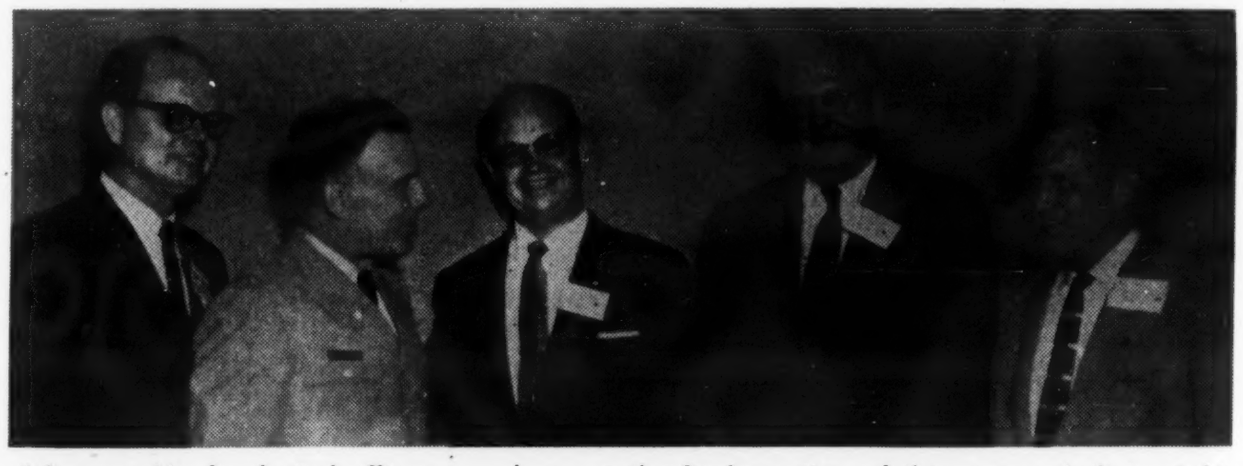
The speaker for the evening was Col. Darce R. Knight, USASTC, who gave a talk and presented slides on Formosa.

Baltimore

Joel M. Jacobson, Vice President and General Manager of Aircraft Armaments, Inc., was host and guest speaker at the April 29th meeting.

A nationally known author of many scientific papers and technical magazine articles and an inventor of many equipments on which he holds patents, Mr. Jacobson spoke on the timely subject of "Cost Control in Research and Development Engineering."

The dinner-meeting was held at the Air Armaments' main building in Cockeysville. A tour of the plant facilities followed the meeting.



Atlanta—Newly elected officers are shown at the final meeting of the season. Left to right: A. M. Wilson, secretary-treasurer; Lt. Col. Donald L. Adams, retiring president; W. B. Bryan, president; A. E. Arnold, vice president, and Lt. Col. Luther J. Ross, vice president. Not included in the picture were Vice Presidents M. S. Hall and Lt. Col. Thomas A. Pugh.

Boston—Kemon P. Taschioglu, Industrial Sales Manager, Polaroid Corporation, featured speaker at the May 8th meeting, demonstrates some equipment to chapter officials. At his right is Robert B. Richmond, new chapter president, and at his left are Col. Murray D. Harris, retiring president, and Fred Moran, a member of the chapter and national board of directors.

Boston

On May 8th, the last regular meeting of the 1957-58 season, Robert B. Richmond accepted custody of the chapter charter, as incoming president for the 1958-59 year, from Col. M. D. Harris, PMST, Northeastern University, outgoing president. Mr. Richmond, who previously served as chapter vice president, is New England District Manager for General Radio Company.

The new president said that he hopes for the same degree of cooperation and interest displayed during the past year by members and workers on the committees, several of which were formed or revived under the presidency of Col.

Harris. His call for a rising vote of thanks to his predecessor as one of the hardest working presidents in chapter history, received a sincere response from the members.

On behalf of the Commander, Boston Naval Shipyard, Reception Committee Chairman Leo F. Norton invited the chapter to continue to use the Yard's fine conference room facilities and other hospitality features as in several years past. The offer was accepted by a membership vote, with due appreciation for its generosity.

Members then heard a talk by Polaroid Corporation's Industrial Sales Manager, Kemon P. Taschioglu, on his company's slide transparency camera and its amazing versatility. Mr. Taschioglu highlighted demonstrations of his product when he opened his talk by screening some remarkably clear slides made of members of the audience only minutes before. "When did he take that of me?" could be heard from points all over the Commander's Conference Room.

The Polaroid representative was questioned for some time at the end of his talk by members, many of whom wanted more details as to special applications of this high-speed transparency-making technique in their own fields.

Representing new group member Trans-Sonics, Inc. at the meeting, was Executive Vice President Edward T. Rigney, who was introduced to the membership.

Willard D. Whitfield, Director of Communications, New England Region, Federal Civil Defense Administration, invited the chapter to hold their next meeting, in September, at his installation at Harvard, Mass., near Fort Devens.

Central Florida

The Strategic Air Command was the subject of the April 25th meeting, held at the Officers Club, MacDill Air Force Base.

A presentation of communications peculiar to the Strategic Air Command was given by Lt. Col. Norman R. Hills, Base Communications Officer, MacDill Air Force Base, assisted by Capt. Floyd Yates. A film on SAC communications followed.

A question and answer session was conducted by Col. Hills at the conclusion of the program.

Decatur

A color film on the DEW Line was the program feature of the April 27th meeting.

Held at the Decatur Signal Depot Officers Mess, the meeting was preceded by a social hour.

Fort Monmouth

Col. A. L. Burke, director of Specialist Training, the U.S. Army Signal School, was named president of the chapter, at the May 15th dinner-meeting at Gibbs Hall Officers Club. He succeeds Halsey Hubbard of the U.S. Army Signal Equipment Support Agency.

Dayton-Wright—Maj. Gen. Victor R. Haugen, Asst. Deputy Commander for Weapon Systems, Hq. ARDC, addressed the March meeting. Col. Sam Mundell, chapter president, is also shown.

Other officers, named at a short business session before the chapter's annual spring dance, were: Norman Freeman of Stromberg-Carlson, first vice president; Col. Robert P. Haffa, Director, Surveillance Department, second vice president; Harry C. Ross, Signal Equipment Support Agency, secretary for a second term, and Thomas R. Schlitz of the Signal School, treasurer.

Gulf Coast

The results of the mail-ballot vote for new officers were announced at the May 6th meeting as follows: president—A. Z. Arseneau, Keesler Air Force Base, elected for a second term; vice president—J. A. O'Connell, Jr., Southern Bell Tel. & Tel. Co.; secretary—G. A. Teunisson, Southern Bell Tel. & Tel. Co., and treasurer—Capt. R. K. Murray, Keesler Air Force Base.

During the program session, Major R. G. Ramsey gave a detailed report on a trip he had made to Elgin Air Force Base, Florida, to observe demonstrations at a test range of the latest aircraft.

Hawaii

Chapter members met on January 30th at Christian's Hut for dinner preceding a tour through KONA-TV television station. Porter Heflin, Production Engineer at KONA-TV and guest speaker at the dinner, spoke on the various problems encountered in the operation of a TV station.

After dinner, the AFCEA members were taken on a complete tour of the station's facilities and were able to discuss the various operations with station personnel.

The Hawaiian Telephone Company was host to the chapter's April 24th meeting.

Members and guests first met at the Oasis Cafe for cocktails and dinner. A movie entitled "Laying of the Trans-Pacific Cable" was shown to the members. The colored film covered the operation of laying the submarine telephone cable between San Francisco and Hawaii. Following the film presentation, members proceeded to Hanauma Bay for a tour of one of the finest and most modern cable terminal facilities of its kind in the world.

London

The Columbia Club, in downtown London, was the scene of the annual Ladies Night on March 20th. The evening's activities commenced at 8:00 when some 150 members and their ladies gathered for cocktails. This was followed by an excellent five-course dinner. Music was provided during dinner and for dancing afterward by Phil Gordon and his orchestra. Mike Black, London cabaret entertainer, acted as M.C. for a very enjoyable floor show later in the evening.

Rear Adm. F. R. Furth, AFCEA's National President, was the guest of honor at a dinner-meeting of the chapter's executive committee on April 29th. Admiral Furth briefed the committee in detail on the aims and objectives of the association for the coming year. Also discussed was the proposed program for the London Chapter in the coming year.

New York

The "Navy of the Future and Its Communications" was presented at the April 30th dinner-meeting by Rear Adm. H. C. Bruton, Director of Naval

Hawaii—1957-58 officers, left to right: Henry Zerbe, finance chairman; Capt. Raymond C. Smith, USAF, program and publicity chairman; Julian J. Lamboley, vice president; Donald C. Kenney, national security chairman; Capt. Joseph F. Dalton, USN, vice president; and Col. Wayne L. O'Hern, USAF, president.

SEND DETAILS OF YOUR NEEDS

London—Chapter officers and guests at the Executive Committee meeting on April 29th in honor of AFCEA National President F. R. Furth. Clockwise, from the far left, are Capt. H. W. Gipple, USAF, secretary; P. D. Canning, associate treasurer; C. G. Mayer, vice president and former president; Admiral Furth; Lt. Col. J. T. Tyler, USAF, president; M. O. Wibmer, guest; Capt. H. Williams, USN, vice president; Sir Reginald Payne-Gallwey, associate vice president; P. A. Turnor, past associate treasurer; L. T. Hinton, associate secretary; Capt. J. S. Dorsey, USN, Acting Director of Naval Communications, Washington, D. C.; J. J. Eades, associate vice president; and Maj. C. L. Bachtel, USA, vice president.

Communications.

Admiral Bruton stated that nuclear developments have dictated some revolutionary changes in naval strategy and tactics. Whereas World War II naval task forces maneuvered in relatively compact formations, present day operations encompass hundreds and sometimes thousands of square miles of ocean area. This naturally imposes several requirements on communications.

The Admiral stated that, "In the equipment field, the Navy is heavily committed to the employment of single sideband techniques for fleet communications using the medium and high frequencies. Introduction of single sideband equipments into the fleet is being accelerated to the extent that funding levels will permit.

"Relatively small quantities of SSB equipment were recently supplied to selected units of the fleets, for test and evaluation. Communication improvement was so marked and the operators so enthusiastic, that considerable pressure was generated by the fleet for immediate provision and installation of such equipment. As a result, several hundred sets of commercial type single sideband transmitters and receivers were bought, literally off-the-shelf, as an interim measure to partially satisfy the requirement, until specially engineered equipment could be developed and procured in quantity for the purpose."

The Admiral also discussed two complementary systems designed to meet Navy requirements for more communication capacity and for transmission of vast quantities of data.

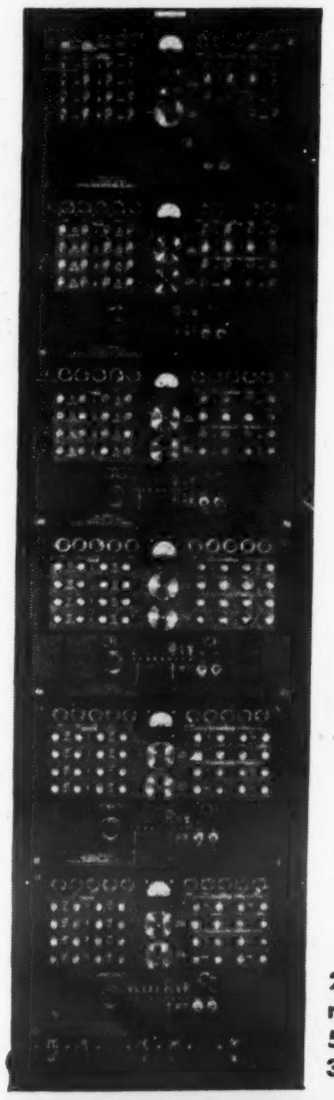
The "High Capacity Communication System" uses techniques which provide fleet units with multiple communication channels in the high frequencies. "The Naval Tactical Data System" provides for receiving information of a tactical nature from a variety of sources for processing, screening, correlating, displaying and exchanging this information via data link among commanders and units involved in a tactical situation.

Speaking of current developments, the Admiral indicated that the Navy is investigating the use of tropospheric scatter and meteor burst propagation for ship-to-shore and ship-to-ship communications. He stated that, "Space vehicles are also envisioned as a powerful means of transferring vast amounts of information and data between terminals on the earth's surface." As a result of 1950 Naval Research Laboratory studies, the Admiral indicated that the Navy is now establishing a relatively high capacity, long haul point-to-point circuit, using moon reflection.

The Admiral mentioned that much thought is also being given to communications applications of man-made satellites using them as both passive reflectors and as active relays.

Admiral Bruton's discussion of the Navy plans for the future and the communication needed to support it was particularly well received by the members and guests of the chapter.

Seated at the head table along with RAdm. H. C. Bruton and Chapter



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These systems provide a voice-channel flat within 1 db from 300 to 3500 cycles, for each 4 kc of bandwidth occupied. Each channel is equipped with hybrid, signalling, and dialling circuits for all the standard 2-wire and 4-wire loop options.

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President Col. Ludwig R. Engler, USAR, were RAdmirals W. A. Brockman and Roy Graham, USN, (Ret.); Commodore John S. Baylis, US Coast Guard, (Ret.); Capt. E. S. Powers, USN; Capt. David S. Rau, USNR; Col. John G. Daiger, USA, (Ret.), and Carl E. Scholz.

Philadelphia

Approximately 100 members and guests attended the May 14th meeting held at the Army Signal Supply Agency to hear James H. Bridges, Director of Electronics, Office of Assistant Secretary of Defense, Research and Engineering, address the group.

Mr. Bridges reviewed the nation's increase in scientific and engineering efforts with emphasis on space research. He pointed out that scientists blame the government for inadequate support to these programs in the past. However, political parties consider inadequate funds the prime factor. New Secretary of Defense Neil H. McElroy, he said, has increased the support on basic research and obtained the necessary funds to carry out an intensive program in this area. Mr. McElroy's plan for the reorganization of the Defense Department proposes the establishment of a Director of Research and Engineering in the Department of Defense. Mr. Bridges pointed out that in the past fundamental research has had starvation budgets and lack of management support, but that today interest is focused on space technology and missile development.

The speaker also stressed the many new electronic principles to be found through basic research.

New York—Rear Admiral H. C. Bruton, then Director of Naval Communications, who addressed the April meeting of the chapter.

Philadelphia—Partial view of the audience at the Army Signal Supply Agency on May 14th which turned out to hear James H. Bridges, Director of Electronics, Office of Assistant Secretary of Defense, Research and Engineering, address the AFCEA chapter.

Rocky Mountain

Approximately 150 people attended the Colorado Springs April dinner-meeting which featured an address by Captain E. E. Hedblom, USN, Chief Surgeon of the Support Forces of "Operation Deep Freeze" (Antarctic Expedition). Captain Hedblom has just returned from Operation Deep Freeze, his third trip to the Antarctic. He plans to make a fourth trip this fall. In the meantime, he is lining up the staff of physicians who will remain at the South Pole stations during the winter to care for Americans making geophysical studies. Captain Hedblom spoke of the duties and responsibilities of such a doctor and told of his experiences.

Due to widespread local interest, the AdAmAn Club and the Navy League of Colorado Springs were invited to join with the chapter in this meeting. Captain Hedblom was the second man to be accorded an honorary membership in the AdAmAn Club of Colorado Springs (Admiral Byrd being the first). Formal notification of his election was made at the chapter meeting.

In addition to distinguished guests from the Army, Navy and Air Force, AFCEA Regional Vice President John Howland of Dage Television was present.

Rocky Mountain—Shown at the chapter's outstanding meeting of the 1957-58 season, are, left to right: Col. O. W. Miller, USAF, chapter president; Brig. Gen. F. F. Uhrhane, Deputy Chief of Staff, Communications and Electronics, NORAD; John R. Howland, AFCEA Regional Vice President; Capt. E. E. Hedblom, USN, Chief Surgeon of the Support Forces of "Operation Deep Freeze," principal speaker; Rear Adm. W. F. Rodee, Commander, Naval Forces, NORAD; Maj. Gen. H. F. Grant, Deputy for Operations, ADC; and Willis McGee, president of the AdAmAn Club.

Rome Utica

At the April 16 meeting held at the Griffiss AFB Officers Club, William L. Roberts was elected president of the chapter. Other officers elected were: Murray Socolof, first vice president; Richard C. Benoit, Jr., second vice president; Fred W. May, third vice president; Albert D. Reisenberg, secretary; Daniel E. Brendiar, treasurer, and three representatives to the national council: William L. Roberts, Fred W. May and Allan A. Kunze.

Those elected to the board of directors included: Maj. Gen. Clyde H. Mitchell, Brig. Gen. Donald P. Graul, Mr. Kunze, Glen H. Sacra, Glen A. Broduck, Harold J. Crowley, Stanley Fishner, Maj. Herman F. Guffey, Darrell S. Kirby and Charles A. Strom, Jr.

Guest speaker was Otto C. Kebernick, Assistant Marketing Manager of Westinghouse Electric Co., who addressed the group on "Atomic Energy —Retrospect and Prospect." Mr. Kebernick's presentation centered on achievements in the use of atomic energy and on forecasts of future uses with their related challenging problems.

San Diego

On May 13th, following a dinner at the Admiral Kidd Club, chapter members and guests proceeded to the U. S. Fleet Sonar School for a program given by the training staff of the school.

The subject of the program was "Live-Sonar — Anti-Submarine Warfare." After a tour of the training

Rome-Utica—The new chapter officers are shown following their election at the April 16th meeting. Left to right, are: Fred W. May, 3rd vice president; Murray Socolof, 1st vice president; Allan A. Kunze, retiring president; William L. Roberts, president; Richard C. Benoit, Jr., 2nd vice president; Albert D. Reisenberg, secretary; and Daniel E. Brendiar, treasurer.

rooms and explanation of use of equipment which was manned by service personnel and explained while in actual operation, two motion pictures, which dealt with a supposed attack on the USA both in the Atlantic and in the Pacific under future warfare conditions, were shown.

During the business meeting, the following additional officers were elected: first vice president — W. C. Garner, Capitol Radio Engineering Institute, who will head the membership committee; second vice president—George E. Pearson, recently Patent Counsel for the U.S. Navy Electronics Laboratory and now Patent Attorney for the Rohr Aircraft Company, who will head the program committee.

The following were nominated to the Board of Directors: Rear Adm. Grover B. H. Hall, USN; Rear Adm. Stanley F. Patten, USN (Ret.); Major Donald L. Mercier, USAF; A. E. Pederson, Communication Engineer, U.S. Naval Communication Station; Marshall Malone, District Manager, Western Union Telegraph Company; Dolores Moore, Moore Electronics, and Capt. John M. Phelps, Commanding Officer U.S. Navy Electronics Laboratory.

San Francisco

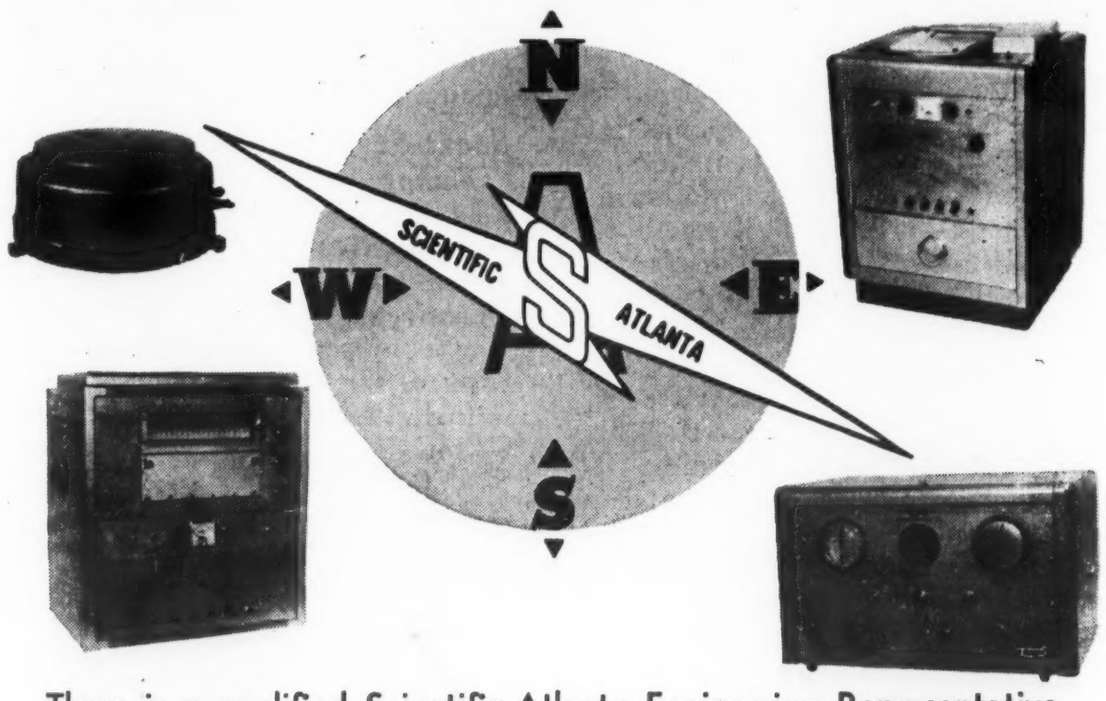
The Western Air Defense Force at Hamilton Air Force Base was host to the chapter for its May 15th dinner-meeting. The mission of Western Air Defense Force was explained and the aircraft used in accomplishment of the mission shown to some 170 members and guests present.

The group heard Brig. Gen. Prescott M. Spicer, Western Air Defense Force Deputy Chief of Staff, Operations, explain the place of WADF in the Air Defense Command picture, and then moved to the Hamilton flight line, where a static display of WADF aircraft was visited. Included in the display were the T-33, F-89, F-86, the Delta Dagger F-102 and the Starfighter F-104 which the week earlier had set a new altitude record and which the next day was to break the existing speed record with a measured flight at more than twice the speed of sound.

While at the Officers' Club, where the chapter had a social hour and dinner, greetings were extended by AFCEA Regional Vice President Ray Meyers, Lockheed, Los Angeles.

Scott-St. Louis—1958-59 officers and directors. Seated, left to right: Kenneth H. Norris, treasurer; Louis E. Dechant, vice president; B. R. Robards, president; Col. Harold L. Hughes, vice president; Allan L. Eisenmayer, secretary. Standing, left to right, are Directors Robert E. Melling, Col. David W. Baugher, Harry L. Cooper; Capt. Paul M. Cowley, A. Lisle Lenny, Harry E. Vermillion, Maj. Gen. Daniel C. Doubleday, Lt. Col. Mike M. Kovar and Clifford G. Wassall. Absent was Director Walter W. Van Skiver.

Wherever You Are . . .



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Southern California—Shown at the head table of the April 22nd meeting are, left to right: Ray E. Meyers, chapter treasurer and AFCEA regional vice president; Rear Adm. Timothy Wellings, USN (Ret.); Arthur N. Curtiss; Rear Adm. Charles F. Horne, USN (Ret.), chapter and national director; Lester R. Daniels, president; John W. Inwood, 1st vice president, who was host at the Western Union tour which followed the meeting; Col. Frank J. Shannon, Sr., USAF (Ret.), secretary; Mr. Harwood, guest; and Directors John Atwood and J. H. Goodrich.

Tinker-Oklahoma City—William H. Forster of Philco Corporation, at left, principal speaker at the April dinner-meeting, is shown with AFCEA Executive Vice President W. B. Goulett (center) and Chapter President Delbert F. Cravens.

Arrangements for the program were made by Col. Joe Bennett, WADF director of Communications and Electronics.

San Juan

During the regular monthly meeting on May 22, the chapter held its annual election of officers. The following were elected: president—Kenneth M. Barbier, President, Radio Corporation of Puerto Rico; 1st vice president—Harry O. Compton, Technical Director, Puerto Rico Telephone Company; 2nd vice president—tied between Alfred C. Weed, Jr., and Captain James D. Whitfield, USN (runoff to be determined at a special Board meeting in the near future); secretary—Albert R. Crumley, Jr., Standard Electric Corporation of Puerto Rico, and treasurer—Jorge N. Toledo, Radio Corporation of Puerto Rico.

Directors elected were: George Alich, Civil Aeronautics Administration; Ralph Quainton, US Naval Communications; Capt. James Hollis, US Army Signal Corps; Joaquin Gandia, Civil Aeronautics Administration, and Julio A. Fuentes, Radio Corporation of Puerto Rico.

Another feature of the meeting included short explanations of the annual Civil Air Patrol encampment by Mr. Crumley and Major Earl McCain, the Air Force C.A.P. Liaison Officer. During the June encampment, 500 C.A.P. cadets were scheduled to receive instruction and military schooling. AFCEA was asked to sponsor two cadets. The resulting motion was unanimously approved.

Scott-St. Louis

Featured at the May dinner-meeting held at Augustine's Restaurant was guest speaker Mr. Renato C. Costarella, Agent-in-Charge, St. Louis Office of the Bureau of Narcotics, Treasury Dept., whose presentation concerned "Functions of the Bureau of Narcotics."

Installation of newly elected officers and directors (see June issue) preceded the evening's program.

Distinguished guests present were Maj. Gen. Frederic E. Glantzberg, USAF, Vice Commander, Hdqrs. MATS, Scott AFB and John M. Black, Vice President, Operations, Southwestern Bell Telephone Co., St. Louis, Mo.

Southern California

Preceding the April dinner-meeting at the Hotel Statler in Los Angeles, chapter members and guest enjoyed a most interesting tour of Western Union's ultra-modern Los Angeles Communications Center. The evening's program, arranged by John Inwood, first vice president and chairman of the program and meetings committee, also featured a showing of the film "From Smoke Signals to Electronics."

In the interest of the large number of non-members present at the meeting, chapter president Les Daniels called on RAdm. Charles Horne, USA (Ret.), to describe briefly the aims, purposes and value of AFCEA membership.

Washington

A dramatic projection of the Navy Polaris Program was given by Rear Adm. W. F. Raborn, Director of the Special Projects Office, Department of the Navy, at the regular luncheon-meeting of the chapter on May 6th at the Willard Hotel.

Admiral Raborn described details of the new surface-to-surface and under-

(Continued on Page 56)

Washington—Pictured at the May meeting are, left to right: Roy Johnson, Director, Advanced Research Projects Agency, Department of Defense, and Rear Admiral W. F. Raborn, Director, Special Projects Office, Department of the Navy, who addressed the chapter on "The Navy Polaris Program."

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ITEMS OF INTEREST

From Government, Industry and the Services

Camera First On Moon?

The first object to explore the moon will be a television camera rather than a human being according to space photographer Lloyd Mallan's predictions.

One of this country's few high-altitude photographers, he asserted that such a proposal has already been made by the Russians. "They may well do it before we do if we don't make a concentrated effort," he added.

The camera, according to Mallan, would be shot to the moon by rocket. Once the rocket was on the moon, the camera, which would be built into an electronically-controlled tank-vehicle, would be released. Steered by radio guidance from the earth, this camera-tank would be free to travel over the face of the moon.

"A camera must get to the moon before man does," said Mallan. "It must map the terrain and clear up many mysteries about the moon's crust—whether that crust is composed of solid rock or treacherous dust, whether or not it is radioactive—and thus the camera will greatly reduce the risk to the lives of men."

The photographer presented these views in a recent issue of *Popular Photography* magazine.

Gatling Design "Borrowed"

The world's fastest-firing aerial machine gun, which will arm the Free World's fastest, most powerful fighter bomber, "borrowed" two design features from the Gatling gun.

The new gun, termed the "Vulcan," has a rotating multi-barreled cluster and is externally driven as was the older weapon. In the Gatling gun of the 1860's, the external power came from a soldier turning a crank; in the Vulcan, the power is either electrically or hydraulically supplied. The Gatling gun design was chosen after a study of every machine gun mechanism patented in the United States.

According to a recent Air Force announcement, the 20 millimeter gun developed by the General Electric Company, will arm the F-105 Thunderchief.

When armed with the Vulcan, the Thunderchief, built by Republic Aircraft, will be capable of greater firepower in 60 seconds than a 400-man rifle company in 20 minutes.

The new gun, a six-barrel rotary firing mechanism, was especially developed by General Electric's Missile and Ordnance Systems Department, under sponsorship of U. S. Army Ordnance, to provide supersonic jets with the firepower necessary for split-second combat. Capable of firing 6000 rounds per minute, or four times as fast as any other existing gun, the Vulcan cannon can be throttled down to slower firing rates for strafing operations.

Collision Avoidance

A California organization has designed a new collision warning and anti-collision command computer for piloted aircraft. The recently unveiled device bases operation upon the principle that the relative velocity vector between two aircraft must coincide with the line-of-sight between them in order for a collision to occur.

When two aircrafts are near enough the same altitude to present a hazard, the relative velocity is computed from altitude, speed and heading information exchanged between airplanes. When this relative velocity is found to lie within a few degrees of the line-of-sight (determined by direction finding equipment), warnings are issued as to the danger. The pilot then is able to alter his course according to the steering command given.

The system, expected to weigh around 30 pounds and occupy approximately 1 cubic foot, does not require an operator's attention. It was designed by the Aerosystronics Corporation of Los Angeles.

"Atomic Clock"

Engineers at the New Jersey laboratories of International Telephone & Telegraph Corporation are developing an "atomic clock" that could be used to guide space travelers. It is visualized as necessary equipment on any future rocket ship which might tour the universe.

The "clock" is a gas-cell device and uses optical pumping and optical detection. According to indications from tests, it is so accurate it would vary only one second in 100 years. This error factor is expected to be decreased as work progresses on the project.

The small, lightweight, portable measuring device is operated by electric power and is relatively unaffected by external conditions. As a result, it is ideal for usage in aircraft and ships.

Light and radio energy in the clock act upon atoms in vapor form in a chamber. The light comes from a vapor lamp using the same atoms as those in the chamber. Roughly similar to the pendulum motion of a mechanical or electric clock, a regular measurable resonance is established.

Fastest Message Printer

First in a new family of super-speed combat teletypewriter units, the world's fastest message printer and code puncher was officially unveiled for public demonstration at the AFCEA Convention.

The new device was developed for the U. S. Army Signal Corps by Kleinschmidt Laboratories, Inc., a subsidiary of Smith-Corona. The unit puts out messages at 750 words a minute—12 times faster than the average typist, five times faster than normal conversation and more than ten times faster than standard teletypewriter equipment.

Instead of ordinary typing keys, the device has a wheel rimmed with letters, which prints the high-speed messages. The wheel spins at 3750 revolutions a minute and at the instant the correct letter comes into position, a tiny hammer places the paper against the type wheel.

Messages are typed on 7/8 inch paper tape as the machine punches out coded holes. Tape comes from the printer at seven and a half inches per second and these messages can be relayed rapidly to other points.

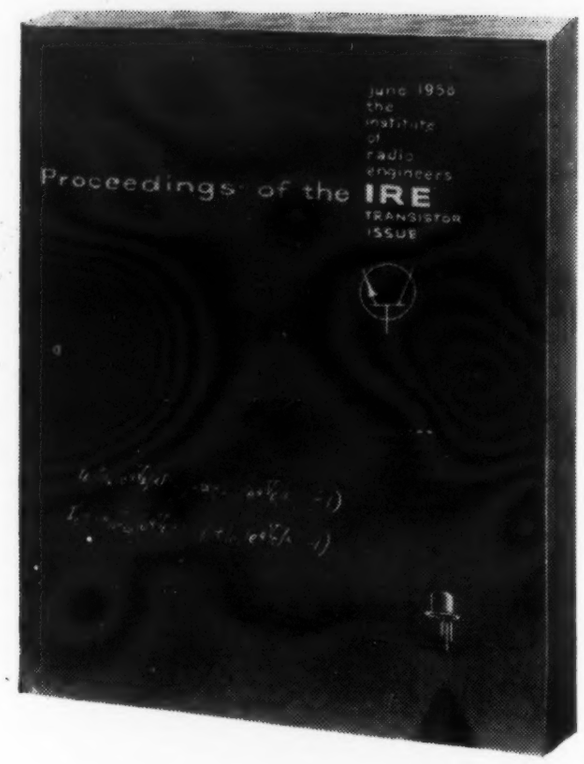
The printer mounts on a jeep or truck teamed to a mobile forward area communications center.

Also, the printer-puncher could be used to feed battle information into a new mobile combat computer now under development. This electronic "brain" will be able to evaluate tactical information and decide on priority targets faster than any human. *(Continued on Page 52)*

SEND DETAILS OF YOUR NEEDS for SIZES and PRICES

THE DECADE OF THE TRANSISTOR

IRE commemorates the tenth anniversary of a major breakthrough in solid state electronics by devoting the entire June issue of PROCEEDINGS OF THE IRE to an up-to-date summary of progress and advances in transistors. So small that many can be held in the palm of one hand, these tiny components have ended our 50 year dependence on vacuum tubes. Without transistors, our intricate guidance and communication systems for missiles would be incredibly big and heavy. With them, whole new technologies are being developed, not only for defense but for industry and commerce as well.



June Issue of Proceedings of the IRE is the New Standard Reference Work on Transistors

Only once before has PROCEEDINGS devoted an entire issue to transistors. That was in November, 1952. Despite a substantial overprinting, every copy was sold within 3 months. This classic issue, coming at a time when there were no books and few papers on the subject, is still considered one of the basic references on the subject...a suitable companion to the definitive Solid-State Electronic issue of December, 1955 and the Ferrites issue of October, 1956.

Now, to mark the tenth anniversary of the transistor, PROCEEDINGS presents the latest advances in theory and application in the June, 1958 issue. Here you will find introductory articles by its inventors—Shockley, Bardeen and Brattain—specially invited papers reviewing progress in all facets of the subject, contributed papers reporting the latest and more important advances in the field. Be sure to order your copy, today!

Partial Contents:

"The Technological Impact of Transistors," by J. A. Morton & W. J. Pietenpol, Bell Labs.
"The Status of Transistor Research in Compound Semiconductors," by D. A. Jenny, RCA.
"Survey of Other Semiconductor Devices," by S. J. Angello, Westinghouse.
"Electrons, Holes and Traps," by W. Shockley, Shockley Semiconductor Lab.
"Recombination in Semiconductors," by G. Bemski, Bell Labs.
"Noise in Junction Transistors," by A. van der Ziel, University of Minnesota.
"Formation of Junction Structures by Solid State Diffusion," by F. M. Smits, Bell Labs.
"Germanium and Silicon Rectifiers," by H. Henkels, Westinghouse.
"The Potential of Semiconductor Diodes in High-Frequency Communications," by A. Uhlir, Bell Labs.
"Advances in the Understandings of the P-N Junction Triode," by R. L. Pritchard, Texas Instruments.
"Power Transistors," by M. A. Clark, Pacific Semiconductors.
"Application of Transistors in Computers," by R. A. Henle & J. L. Walsh, IBM.
"Application of Transistors in Communication Equipment," by D. D. Holmes, RCA.
"Characteristics Data on Silicon and Germanium," by E. Conwell, Sylvania.

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Secretary Brucker's Speech

According to Secretary of the Army Wilber M. Brucker, America realized during the Korean War that it owed its soldiers better weapons, better equipment—a better chance against the massed manpower of the Communist enemy. He made the remark in a speech prepared for delivery at Fort Bragg, N. C., to the Army Scientific Advisory Panel.

"Korea gave the impetus needed to begin a vast program of scientific research and development aimed at providing modern military tools," he said.

The Army must, he added, continue in every possible way, to support creative research in order to expand existing knowledge.

The Secretary said that Korea showed clearly that the Army in the future would have to possess weapons and techniques capable of "equalizing" the situations it might have to meet in a limited war situation produced by Communism.

The forces of the Free World must be ready to oppose further expansion of the Communist threat, short of nuclear war, the Secretary said. And he explained that these will have to be hard-hitting, mobile forces, using every advantage they can get from science to counteract both the manpower and the science of the Soviets.

New Microwave Amplifying Technique

According to a company spokesman. a radical advance in microwave amplifying techniques has been achieved by scientists of the Radio Corporation of America. Dr. Irving Wolff, Vice President, Research, RCA Laboratories, reported the step may reduce the size and improve the performance of radar equipment for missiles, satellites and aircraft.

The advance is a basic improvement in a solid-state device known as a parametric microwave amplifier. In the RCA development, an experimental germanium diode is used to detect an incoming high frequency signal. Associated with the diode is either a transistor or a "pencil-type" tube oscillating at a lower frequency to provide a "pumping" action that amplifies the signal.

According to the scientists responsible for the amplifier, parametric microwave amplifiers previously have been considered impractical for operation at the very highest frequencies because they have required a pumping frequency higher than that of the signal to be amplified.

They stated that their development of a new technique that permits use of a pumping frequency lower than the signal frequency has placed the parametric amplifier principle "in an entirely new light," promising to "push back the present practical frequency and signal-level limitations to microwave communications."

7th U.S. Cavalry

In an effort to maintain the traditional Cavalry spirit in today's modern army, the 7th U.S. Cavalry Association is functioning as the point of contact for all former members of the 7th U.S. Cavalry Regiment. In order to provide information, addresses and to maintain records of all former members of the regiment, the Association has urged all personnel who have ever served with the regiment to forward their name, rank, serial number, former 7th Cavalry unit with dates of service and present address to: Seventh U.S. Cavalry Association, 1932 West 43rd Place, Los Angeles 62, California. The annual Association membership dues are $1.00.

Names in the News

Joseph B. Elliott has been elected President of Tele-Dynamics Inc. He was formerly Executive Vice President and General Manager. Mr. Elliott will continue as Executive Vice President of Raymond Rosen & Co., Tele-Dynamics' corporate parent.

Kenneth F. Morgan will retire this month as Manager-government sales, Radio Division of Western Electric Company, Inc., and is succeeded by **William H. Doherty**. Mr. Morgan joined the Radio Division of Western Electric in October 1949 as manager of special projects engineering.

Admiral Joseph J. Clark, USN (Ret.), has been named Assistant to the President of Van Norman Industries, Inc. He will coordinate scientific research and development among the organization's eight manufacturing divisions.

William G. Thompson retired recently as Assistant Vice President in the American Telephone & Telegraph Co.'s Long Lines Department. Mr. Thompson's responsibilities will be assumed by **Harold M. Botkin**, also a Long Lines Assistant Vice President.

Frederick R. Lack, who will retire in August as Vice President of Western Electric Company's Radio Division, was presented a plaque by AFCEA during the Convention. The award read, "To Frederick R. Lack—organizer, charter life member, past president and director—in appreciation of his twelve years of unselfish devotion to the interests of this Association."

A. J. Barran has been elected President and a Director of General Telephone Company of the Northwest, a subsidiary of General Telephone. He succeeds **W. R. Jarmon**, who has been elected a General Vice President of General Telephone Corporation in New York City.

Raymond Davis has retired as Chief of the Photographic Technology Section of the Optics and Metrology Division at the National Bureau of Standards after more than 46 years of service. He directed the Bureau's fundamental research and testing program in photography for many years.

David R. Hull has been elected President of the Electronics Industries Association. Mr. Hull, Vice President of Defense Programs of the Raytheon Manufacturing Co., succeeds **Dr. W. R. G. Baker**.

Maj. Gen. James Dreyfus, Chief, Procurement & Distribution Division, Office of the Chief Signal Officer, next month will succeed **Rear Adm. William D. Irvin** as Deputy Director for Communications & Electronics on the Joint Chiefs of Staff. **Brig. Gen. Herbert L. Scofield** will succeed Maj. Gen. Dreyfus.

Brig. Gen. Ralph T. Nelson, who presently commands the U. S. Army Electronic Proving Grounds at Fort Huachuca, Arizona, will become the Deputy Chief Signal Officer of the Army in August. **Maj. Gen. Emil Lenzner**, whom Gen. Nelson succeeds, will join the faculty of the University of Arizona as Associate Dean of the College of Engineering, following his retirement this summer.

George W. Bailey, a Director of AFCEA and Executive Secretary of the Institute of Radio Engineers, has been awarded the honorary Doctor of Science degree by Lawrence College, Appleton, Wisconsin. The degree was presented by Douglas Knight, President of the college. Congratulations.

LCmdr. Nelson M. Cooke, USN Ret., President of Cooke Engineering Company, Wash., D. C., recently received on the behalf of his company, the Navy Certificate of Merit awarded by Rear Admiral Albert G. Mumma, Chief of BuShips. The award was presented for the complete planning, provisioning and installation of the Londonderry, North Ireland radio station, an outstanding contribution to the Department of the Navy in the field of communications-technology.

NEW PRODUCTS FROM INDUSTRY

First Practical Sunlight Converter

The first practical system of converting sunlight into electrical power for the commercial tasks of operating telephone systems, telegraph networks, radios and other communication and signal devices has been developed by the Hoffman Electronics Corporation's Semiconductor Division of Evanston, Illinois.

The basic component of the new system is said to be a "modular unit," a 12- x 12-inch aluminum panel containing 144 wafer-thin, circular silicon solar cells which instantaneously convert sunlight directly into electrical energy. This energy is either fed into storage batteries or used directly.

The 144 silicon solar cells in the "modular unit" will supply five watts of power to a six-volt battery system 24 hours a day, year in and year out, without replacement or maintenance.

Cost of the solar battery system is said to be considerably higher than the number of storage batteries required to produce the same electrical output, but over a period of years the cost of maintaining and replacing batteries is claimed to be well in excess of an investment in a solar power system which eventually provides free electric power.

Device "Speaks" From Punched Keys

A recently demonstrated electronic instrument which provides a readout of coded information in the form of prerecorded words and phrases has been described as a device that "speaks" words and phrases when an operator presses the proper keys.

Called Selvox (selective vocabulary), the instrument triggers the proper word by means of a relatively simple electronic signal.

Since a coded electrical signal is simpler to transmit than voice. and because it is much less effected by interference or static, the device holds promise for application in solving major problems in aircraft, ground, point-to-point and shipboard communications. For example, a spokesman for the developer—Hoffman Electronics Corp., 3761 S. Hill St., Los Angeles 7, Calif.—explained that since most military operations employ stereotyped words and phrases to execute maneuvers, it is possible to program standard commands in the electronic memory drum of the unit which will then speak the commands when the proper coded signal is received.

The concept of Selvox was cited as a means of relieving some of the overcrowding in the radio spectrum since the coded signal requires much less space in the frequency spectrum than transmission of actual words.

A further application would be the recording of words in other languages, allowing the same transmitted signal to be heard in whatever language the receiver's memory drum "speaks."

The airplane pilot was considered another beneficiary of the device since oral commands, when compared with visual information in the cockpit, are a more positive means of transmitting data.

Rare Earth Poly-Crystalline Materials

The first commercial production of yttrium-iron garnet (YIG) together with other rare earth polycrystalline materials has been announced by Microwave Chemicals Lab., Inc., 282 Seventh Ave., New York 1.

YIG is said to offer much lower loss characteristics than conventional microwave ferrites in the microwave region. Moreover, the material has a ferrimagnetic resonance line-width of 55 oersteds at 9,000 mc. and 30 oersteds at 3,000 mc. Other types of rare earth materials have line-widths varying from 50 to 2,500 oersteds.

Saturation magnetization of YIG is very low (1,750 gauss), and can be varied by changing the chemical construction of the material. Values as low as 450 gauss have been indicated for some materials.

Applications for YIG include isolators, rotators and parametric amplifiers.

New Battery Concept

The product of five years' research, a new concept in battery-heating has been achieved by the American Machine & Foundry Co. of New York for the guided missile industry. AMF has developed a quick-heating, brick-size chemical battery which provides instant electrical power for missiles which must be stored and then fired quickly at sub-zero temperatures.

The compact, high-power, silver-zinc battery contains a built-in chemical heater which automatically brings the battery to operating temperature in 6 seconds. Former batteries needed several minutes of heat-up time and were heated electrically by an outside power supply.

"Voices of The Satellites"

The authentic radio signals from Sputnik I and II, from Explorer I, II and III and from the Navy's first Vanguard have been recorded on both tape and disc. With the aid of his specially built converter that amplifies weak signals, Professor Thomas A. Benham recorded the signals as they were first received in his electronics laboratory at Haverford College.

On 5" reel, 2-track magnetic tape or a 10" LP disc, the recordings are presented with clear explanation of their complicated scientific significance in terms the average person can understand. Entitled "Voices of the Satellites," both tape and disc are being solely distributed by Taben Recordings, Box 224, Ardmore, Pa., and each may be purchased for $3.95.

Signals call over the background of clicking telemetering equipment, as position, time of passage, speed, temperatures and meteorite dust collisions are recorded.

Professor Benham, who is totally blind, is well-known for his work in the electronics field and for his development of scientific devices to aid the blind. In addition, Professor Benham produces a nonprofit science magazine on magnetic tape—*Science For The Blind*—which issues 400 recordings monthly.

New Inspection Device

The "Atomonitor," a machine which is believed to employ radioactivity for the first time to inspect production-line assemblies for the presence of hidden vital parts, has been developed by the Nuclear Corp. of America of New York.

The U.S. Army Ordnance Corps has purchased the first model for checking artillery-shell fuse heads to make sure they contain a complete firing-pin assembly.

Other applications include the inspection of instruments, electrical and

electronic apparatus, motor components and "almost any relatively small assembly" in which the vital part cannot be seen or felt once the assembly is complete.

The parts which the Atomonitor "looks for" are plated with 1/100th of a microcurie of radioactive silver. This material is said to be inexpensive and easy to apply and to present no health hazard. Its radioactive longevity permits inspection up to a year after plating.

Assemblies to be inspected go through the Atomonitor on a conveyor at a rate of up to 3000 an hour, while a scintillator in the device checks each unit for radioactivity. If it finds none, it automatically ejects the assembly into a bin below. Counters indicate the number of units inspected and the number rejected.

Further information may be obtained from the corporation's NRD Instrument Division, 400 Park Ave., New York 17, N.Y.

New Miniature TV Camera

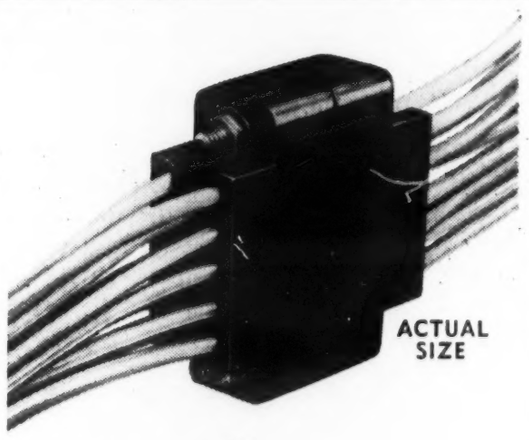
Featuring complete transistorization, automatic control and extreme reduction in size and weight, a new TV camera, Model 333, has arrived on the market from Dage TV Division of Thompson Products, Inc., West 10th St., Michigan City, Indiana.

Claimed to be unique in the equipment is the provision of automatic light-level compensation for electronic self-adjustment of the camera circuits with light-level changes within a range of 250:1 together with the provision of noise-reduction circuits to present a clean picture at low light levels.

No cables or knobs are required for operational adjustment of vidicon target voltage, beam current and electronic focus current.

The electronic circuit construction of the camera is modular. Power requirements are said to be obtained from virtually any source of power, AC or DC, and the camera is able to transmit a signal over a coaxial cable to a monitor 2000 ft. away, without a line amplifier. The synchronizing generator has crvsta! controlled count-down, providing full interlace with EIA svnc and equalizing pulses composite with the output video signal.

It is believed that the "333" camera concept will lend itself to the design of transistorized weapons systems and TV equipment which must meet requirements of advanced aircraft, missile and other military systems.



HYFEN™ Connectors

Save Weight, Space, Time

Crimped contacts that snap-lock in place, either on the assembly line or after the connector has been mounted on the equipment, add a new dimension of Reliability to the connector field. All HYFENs, such as the Miniature MS-type illustrated, are designed to replace or mate with virtually all existing connectors. For detailed information, write:

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New Literature

Directory of Electronic Test Instrument Manufacturers

A revised second edition of Volume Four in the *Directory of Technical Specifications* has been published by the Technical Information Corp., 41 Union Square, New York 3, N. Y.

The new edition lists manufacturers of all standard electronic test instruments as well as their representatives and field offices, and it identifies the method of selling in each state.

Small Business Directory

The Small Business Administration has issued a 106-page book entitled *The U.S. Government Purchasing and Specifications Directory: A Guide To The Government.* The Directory describes the method of government purchasing and explains how the SBA can aid small firms in obtaining government contracts.

Suggestions on selling to government contractors are given, the major items and services purchased by military and civilian agencies are described and the purchasing offices that buy them are named. Included is a listing of military installations by states which are responsible for local purchases.

The directory, a revision and combination of two previous SBA publications, may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C., for 55c.

Electronics Reliability Bibliography

A joint program conducted by the U.S. Navy Bu-Ships and by industry which is aimed at promoting reliability in design and production of electronics equipment has given rise to the publication of a projected series of reference publications. Of this series entitled *NEL Reliability Bibliography* (Navy Electronics Laboratory), the first two volumes are now available to industry.

The first publication is a basic 104-page bibliography compiled in April 1956 and the second 160-page volume is the first of the series of supplements designed to keep the bibliography current. They may be purchased at $2.75 and $3.00, respectively, from OTS, Dept. of Commerce, Washington 25, D. C.

Both publications contain references to published material appearing since 1950 and the reliability research is covered in ten areas of electronics R&D.

Extension Courses Booklet

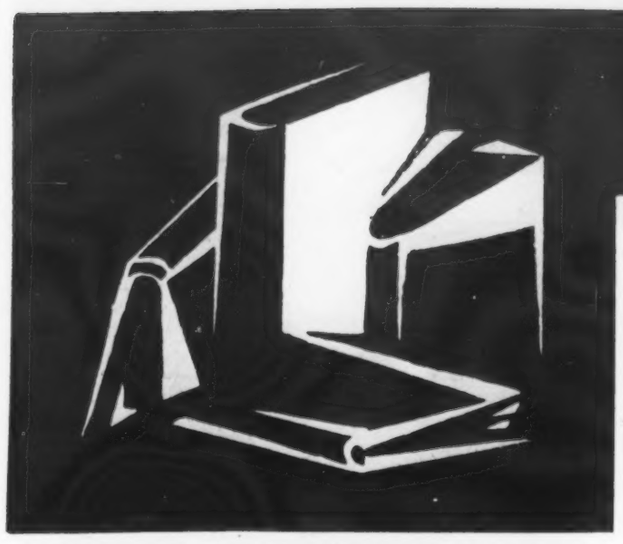
A new 32-page, 1958-59 catalog of the Signal Corps extension courses is available on request from the Director, Dept. of Nonresident Instruction, U.S. Army Signal School, Fort Monmouth, N. J.

The booklet lists almost 100 correspondence subcourses which are available to all Armed Forces personnel including the Reserves, the ROTC and the National Guard. Courses are also open to Dept. of Defense civilians.

How-To-Build-It Bulletin

CBS-Hytron's Advertising Service, Parker St., Newburyport, Mass., is offering an instruction booklet on how to build and operate a miniature 40-watt transistorized power supply, employing two 2N256 power transistors.

Operating from a 12-volt battery, the unit is small enough to hold in the palm of the hand, but husky enough to handle a steady load of 40 watts and a peak load of 90 watts.



Books

NOTES ON ANALOG-DIGITAL CONVERSION TECHNIQUES, by Alfred K. Susskind, Ed., John W. Brean, Martin S. Osman, Douglas T. Ross and John E. Ward. John Wiley & Sons, New York, and The Technology Press, MIT, Cambridge, Mass. 410 pages, $10.00.

Prepared by five staff members in the Servomechanisms Laboratory of the Massachusetts Institute of Technology's Department of Electrical Engineering, the volume considered here is the outgrowth of a special summer program given on the subject last year at MIT.

Fundamental concepts are expressed in quantitative terms where possible. The authors consider inherent engineering limitations and weigh the relative merits of various approaches.

Subject matter is divided into three sections. Part I pertains to systems aspects of digital information processing which influence the specifications for analog-to-digital and digital-to-anolog conversion devices. Part II presents a detailed engineering analysis and evaluation of a variety of conversion devices. And Part III is devoted to a case study based on development work done at the Servomechanisms Lab.

The work incorporates the authors' laboratory experience with numerical control of machine tools and with digital instrumentation which directly records experimental data in a form suitable for processing by digital computers.

FORGING A NEW SWORD: A Study of the Department of Defense, by Col. William R. Kintner, Col. Joseph I. Coffey and Raymond J. Albright. Harper & Bros., New York. 238 pages, $4.50.

Colonel Kintner and his associates have authored an excellent work on a subject of momentous importance and of extreme complexity, that of the strengths and deficiencies of our present defense system.

Buttressing their commentary on official documents, recent events and personal interviews with Pentagon officials, the authors probe the problem of governmental and military organization, appraising the national defense structure by means of ten criteria: civilian control, national policy formulation and planning, readiness, strategic doctrine, weapons systems innovations, flexible adjustment in missions, maximum cost efficiency and motivation and morale.

Setting forth a convincing argument on the need for a fundamental change of the defense organization, the authors propose recommendations similar to those of the President and the Rockefeller Commission.

Considered an excellent source for historical background of the DOD evolution, the book for its logical analysis should prove to be of greatest value to policy-makers and spokesmen of public opinion in the defense reorganization debate.

Says W. W. Rostow of MIT in the Foreword, "Defense matters usually reach public attention only in the form of interservice quarrels and budgetary debates, or on other enflamed occasions, as with the Soviet satellite of October 1957. This book is, then, an exercise in expanding the democratic processes. . . ."

BEHIND THE SPUTNIKS, by F. J. Krieger. Public Affairs Press, Washington, D. C. 380 pages, $6.00.

Dr. Krieger's survey of Soviet astronautics is a comprehensive effort to uncover evidence of increasing Soviet concern with the challenging problems of space flight.

Based entirely on open literature, the study provides important insights into Soviet intent and aspirations throughout its authoritative presentation which treats such matters as artificial satellites, flights to the planets, interplanetary communications, biological aspects of space travel, atomic airplanes, world-wide TV broadcasting from space stations, intercontinental rocketry and the technical problems of cosmic flight.

Opening the work, an introduction sketches the historical background of astronautics in Russia from the turn of the century to the launching of Sputnik I. Forming the main portion of the book are articles and papers translated from the Russian and a bibliography composed of over 339 items listing book and monograph sources together with references drawn from various newspapers, magazines and technical journals.

Dr. Krieger, staff member of the Rand Corp. (a nonprofit organization conducting long-range research for the Air Force), was a key figure in assembling vital information on Russian space science for the U. S. prior to the Sputnik launchings.

THE ATOMIC AGE AND OUR BIOLOGICAL FUTURE, by H. V. Brondsted. Philosophical Library, New York. 80 pages, $2.75.

Mr. Brøndsted's timely book discloses the biological and, particularly, the genetical effects that may ensue from the increasing use of atomic energy. Radiation, according to the author, brings to the fore problems of social and biological reference which are inseparable from peaceful utilization of atomic energy.

Although atomic energy, in the author's opinion, is the only energy that will never be exhausted, it nevertheless presents many unresolved problems. One to be considered is the decline of employment resulting from the automation to accompany atomic power. Another is the danger of releasing forces that dictate a complete change in the structure of our society.

Clearly, the author's prime objective is to foster an awareness of the most outstanding problem—the dangerous effect of radioactivity upon the genetical development of man—and, as background reference, he details the structure and behavior of the atom and describes the development of the human embryo and the mechanisms of heredity.

MODERN RUSSIA, by John Long. Philosophical Library, Inc., New York. 180 pages, $6.00.

Addressed primarily to the serious but non-specialist reader in search of a factual commentary on post-Stalinist Russia which is devoid of speculation and dramatic detail on popularized episodes, Mr. Long's study searches to define trends in Soviet policy and provides background information with which the inquiring reader may make his own conclusion about Soviet aims and achievements.

Topography, climate, vegetation and mineral resources; peoples, races, languages and customs; industry, agriculture and transport; the system of government in a one-party state, and Soviet relations with other countries—these are the main subject areas covered, all well supported by maps and graphs. A select bibliography is included among the 5 appendices.

Chapter News

(Continued from Page 48)

water-to-surface Intermediate Ballistic Missile System currently being developed by the Navy.

"The basic difference between the Polaris and other missiles under development," explained Admiral Raborn, "is the launching of the Polaris missile from a submerged nuclear-powered submarine. This required many new and radically different design features —including the use of a solid fuel— to permit carrying a sizeable number of missiles in a single submarine without increasing the size of such vessels beyond present nuclear-powered submarine dimensions."

Development of the Polaris system has passed from the scientific stage to the development stage and the weapons systems should be operational by 1960, according to Admiral Raborn. "Polaris will add to the United States' network of land bases, both in this country and overseas, a system of mobile and fully concealed missile launching 'bases' wholly under our own flag and control. Polaris will bring within range of direct attack from the sea virtually all important military targets in the Communist-controlled heartland. It can reach these targets in some fifteen minutes from the instant of firing."

With their world-wide cruising radius, nuclear-powered submarines can patrol the worlds oceans for months at a stretch, stated Admiral Raborn.

"The very knowledge that they are there," concluded Admiral Raborn, "that they are within range and ready to launch their missiles within minutes, would exert a strong and constant deterrent influence on any aggressor nation."

Important feature of the luncheon meeting was the election of officers and directors of the chapter for the 1958-59 season.

New president is John R. O'Brien of Hoffman Laboratories, who replaces L. Harriss Robinson of Motorola, Inc. Four vice presidents elected were: Maj. Gen. Emil Lenzner, USA; Capt. J. S. Dorsey, USN; Brig. Gen. John G. Bestic, USAF, and John N. Boland, Raytheon Manufacturing Co. New Secretary-treasurer of the chapter is A. W. Christopher, Jr., of Sylvania Electric Products.

Sixteen members of the board of Directors for the chapter were also elected. These were: W. W. Alvis, Western Union; Percy G. Black, General Telephone; George Sheets, Stromberg-Carlson; Capt. G. L. Countryman, USN; Ralph I. Cole, Melpar; H. A. Crossland, General Electric; Francis H. Engel, RCA; John F. Gilbarte, Admiral Corporation; Paul Goldsborough, Office of the Secretary of Defense; Col. Gordon Gould, USAF; Rear Adm. W. D. Irvin, USN; Keith B. Lewis, Eastman Kodak; Lloyd Miller, AT&T; Brig. Gen. H. L. Scofield, USA; Col. I. F. Stinson, USAF, and Capt. W. E. Sweeney, USN.

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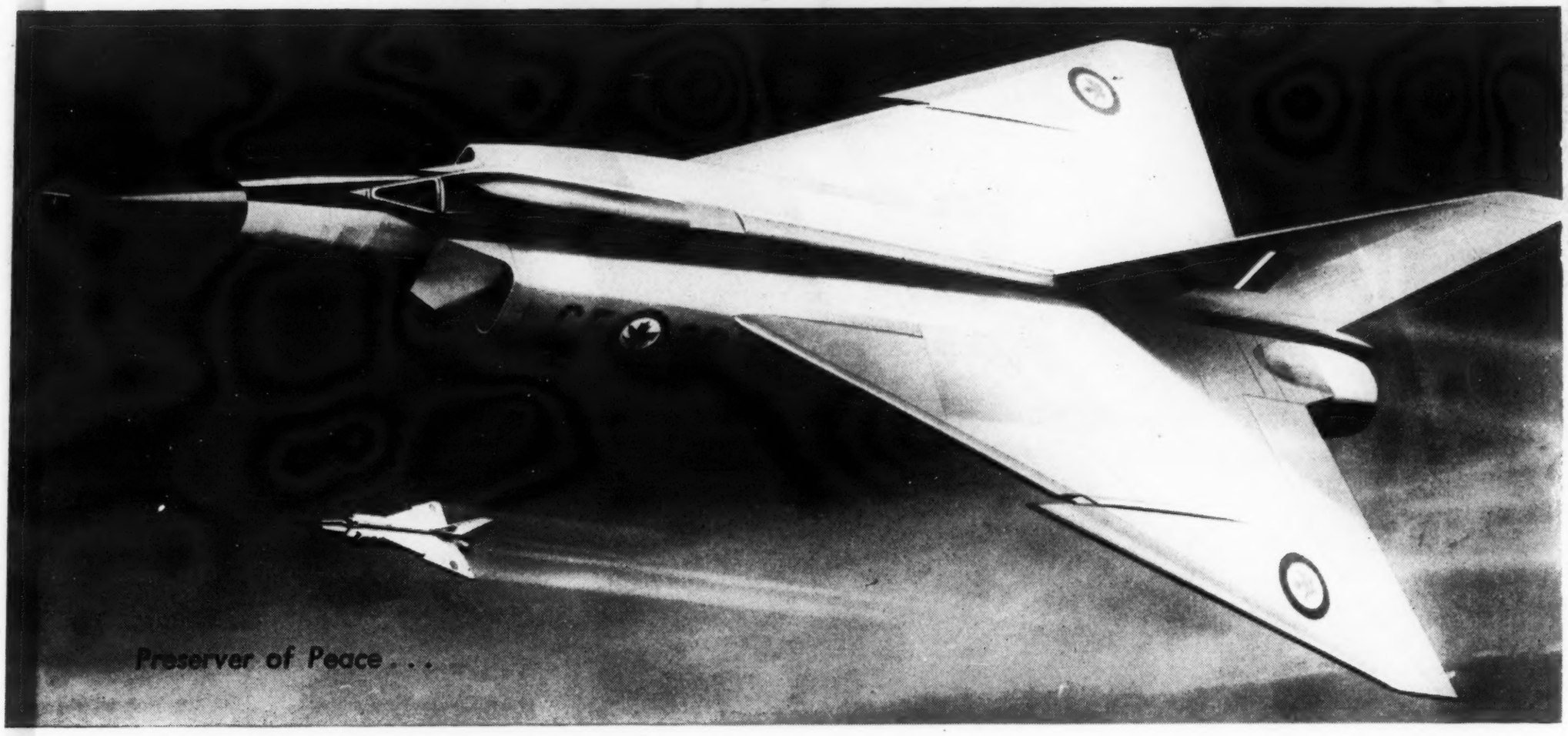

CANADA'S SWIFT, FAR-RANGING ANSWER TO ANY SECURITY THREAT

Every advance in aircraft engineering is exemplified in the Avro Arrow, capable of traveling at well over twice the speed of sound to intercept and destroy enemy aircraft at extremely high altitudes. RCA has been assigned full responsibility for the development of a complete electronic system for fire control, navigation and communication, and an integrated automatic flight control system. While an enemy plane is still beyond the range of human eye, this radar system will detect it, and provide the intercepting pilot with a continuous flow of information, electronically computed in terms of position, range and rate of closing. Associated with RCA in the project are the Minneapolis-Honeywell Regulator Company and several Canadian firms.

RCA Tmk(s) ®

RADIO CORPORATION of AMERICA

DEFENSE ELECTRONIC PRODUCTS

CAMDEN, N. J.

WHILE NERO FIDDLED

One windy Tuesday in Rome during the reign of the infamous Nero, a new mobile radar unit, on its way for delivery to the emperor's legions outside the city, suddenly caught fire. A tube blew, the sparks flew, the horses bolted, and soon all Rome was ablaze.*

Nero was furious. He had the members of the ill fated crew brought before him. "I'll make the punishment fit the crime!" he roared. While he thought about it, he picked up his violin and began to play. Since he was the vilest of violinists, the feelings of his listeners may better be imagined than described. He scraped his

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the reign of the , on its way for e the city, sud- sparks flew, the laze.

embers of the ill ake the punish- he thought about play. Since he of his listeners He scraped his way through 'Keep the Rome Fires Burning' and 'Smoke Gets in Your Eyes.' At last he paused, confronting his trembling listeners.

"I'm going to have you all boiled in oil!" he boomed.

"THANK GOODNESS!" one of the doomed wretches exclaimed fervently as they were being led away. "For a minute I thought he was going to play 'Smoke Gets in Your Eyes' again!"

The obvious moral: *It doesn't pay to go horsing around with inferior tubes.*

AR THROUGH THE AGES

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CONVENTIO REPORT

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August
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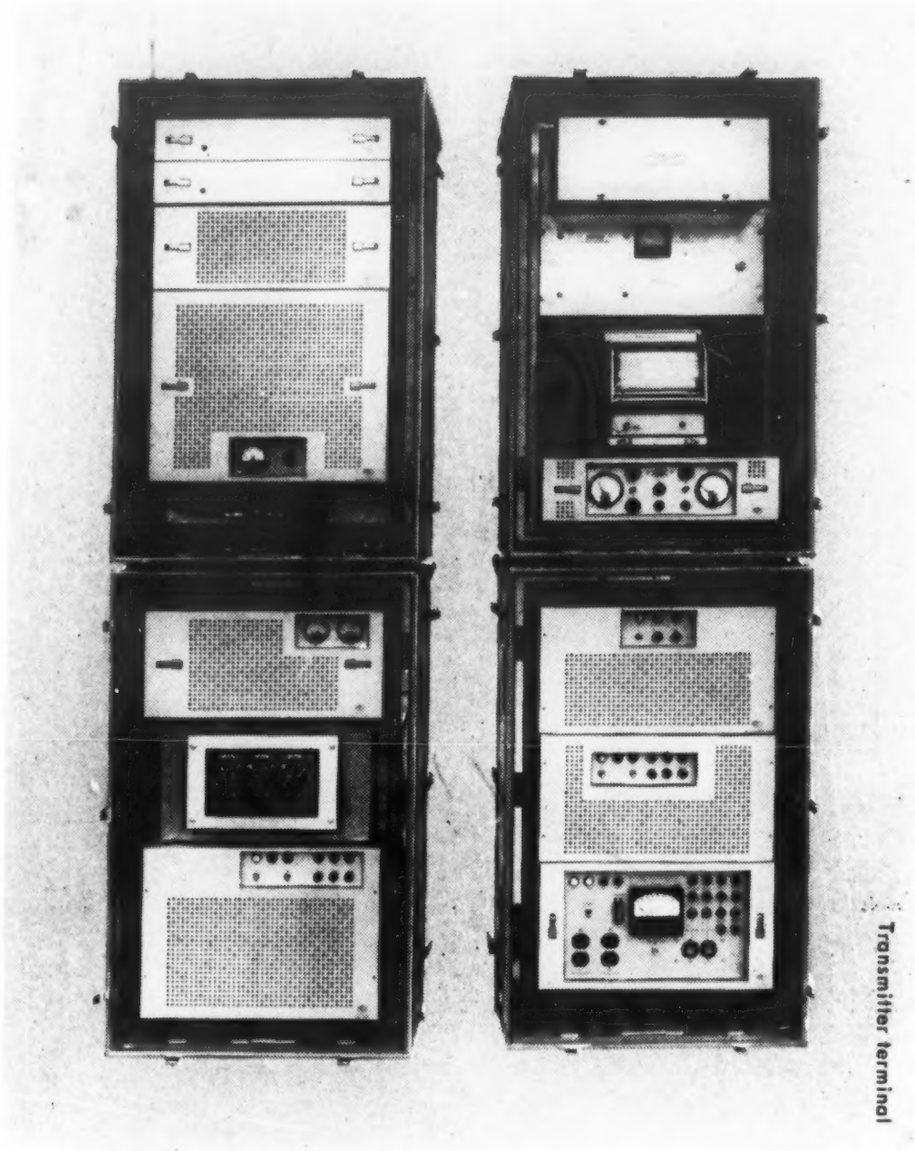

Transmitter terminal

Propagation testing made portable

With the continual increase in tropo scatter systems—most of which have been developed and manufactured by REL—has come heightened need for truly portable propagation test equipment to survey proposed scatter transmission paths.

The solution is available in REL's new path test set. Here, for the first time, is packaged transmitting and recording receiving apparatus which is not only small and light, but supremely rugged as well.

Packaged with each set are replacements for all necessary components, many in preassembled form. Parts supply depots are unnecessary, and delays thereby eliminated.

Complete details may be obtained upon request.

SYSTEM

Frequency range: 875 mc to 950 mc*
Power output: 20 or 120 w
Noise threshold: —167 dbw or 0.032 μv in 50 ohms
Recording range: 60 db, 40 db, or 20 db—log-linear
Radio gain: 180 or 188 db
Frequency stability: ±1 pp 10^5 short term
±1 pp 10^7 long term
Primary power: 120 volts ±10%, 50-63 cps
Ambient operating temperature: —18° to +54°C
Non-operating temperature: —65° to +85°C

TRANSMITTER

Modulation: None; cw operation. Provision is made to key power output for identification.
Power output recording: 6-inch strip recorder available

RECEIVER

Bandwidth: 1 kc
Noise figure: 7 db
Recorder: 6-inch strip recorder
Calibration: Signal level and recording linearity by internal means.

MECHANICAL

All cases are 26 1/16" wide by 20 5/16" deep by 40 9/16" high
Cases may be stacked two high during operation.
The weight varies from 200 lbs to 350 lbs depending on case contents.

**Also available in ranges of 435-475 mc & 1750-1900 mc*

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A subsidiary of Dynamics Corporation of America

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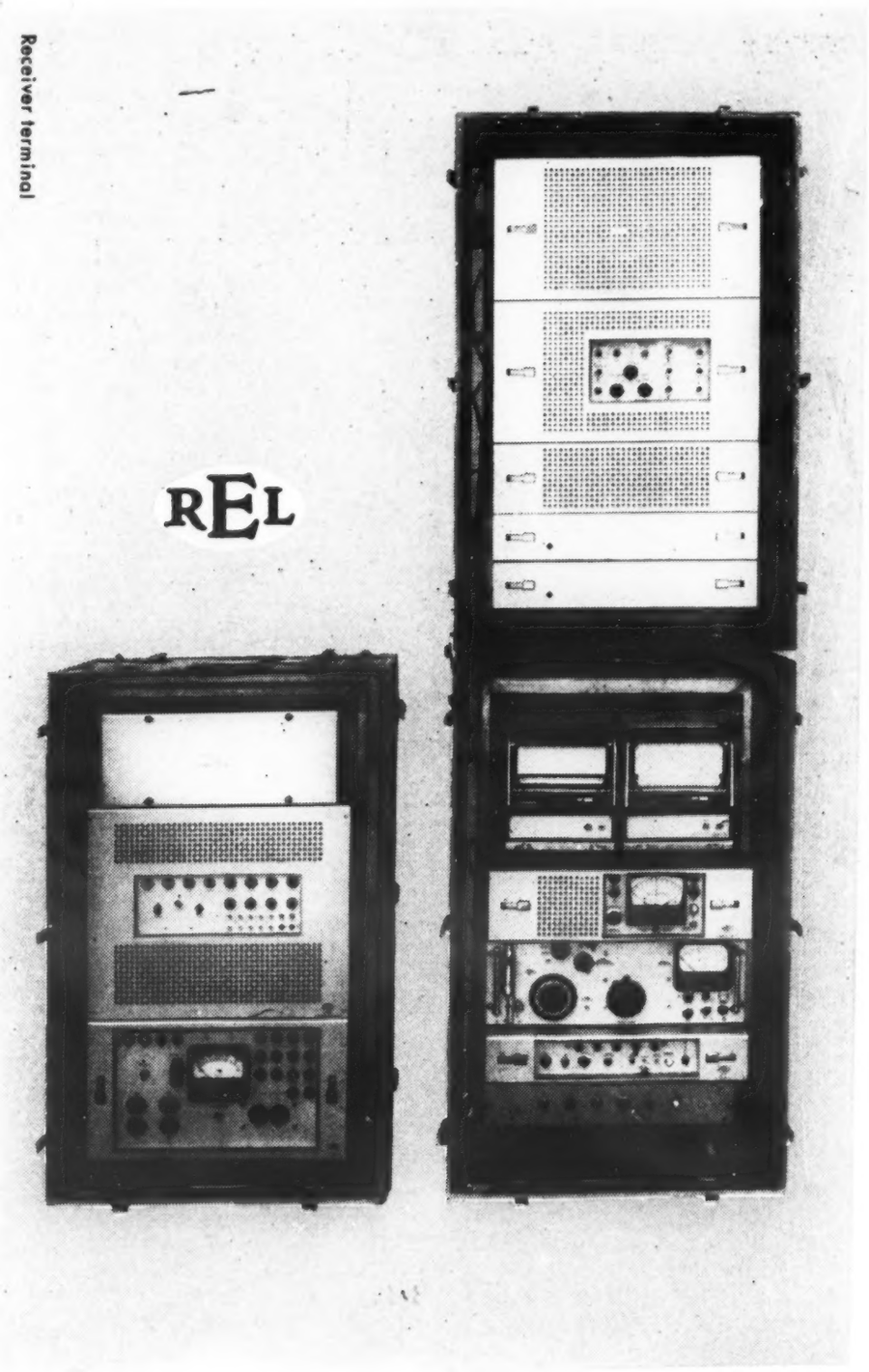

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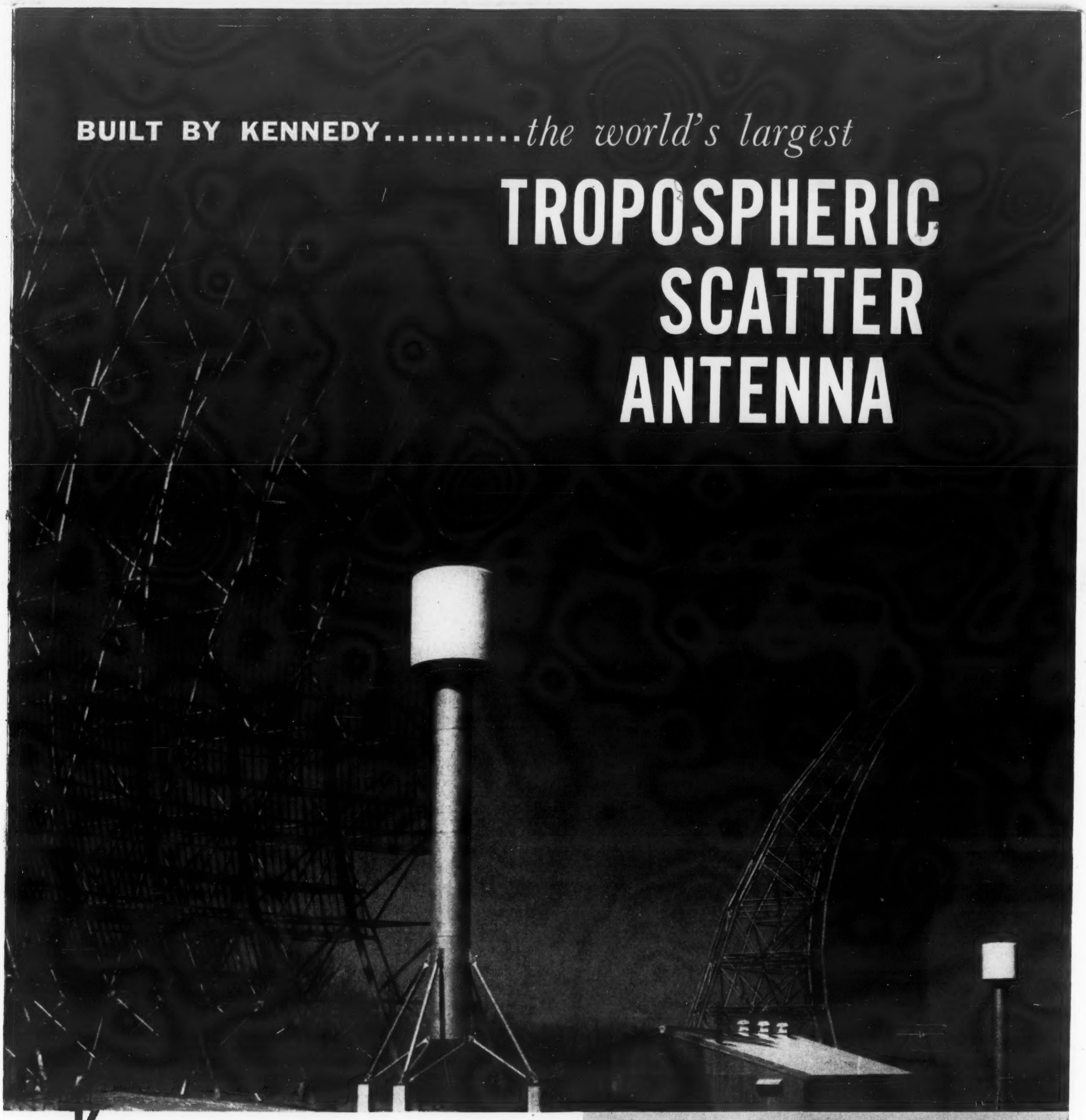

KENNEDY's new 120 foot Trans-Horizon® Antenna represents today's most advanced concept in tropospheric scatter antenna systems.

This huge reflector is supported by a galvanized steel frame. The feed horn is mounted separately atop a 55-foot steel tower. Wave guides, as well as a ladder for all-weather adjusting, are accommodated within the tower. The "Trans-Horizon 120" can operate in winds up to 180 M.P.H. with 12 inches of ice. Also available: Moderate duty model for winds up to 110 M.P.H.

Here is still another instance of the ability of Kennedy engineers to design and build any antenna within the realm of creative engineering imagination. Can this unmatched know-how be put to work for you?

ANTENNA EQUIPMENT

D. S. KENNEDY & CO.

Route 3A, Cohasset, Mass. EVergreen 3-1200

Down-To-Earth **SOLUTIONS** *to Out-Of-This-World* **PROBLEMS**

- Tracking Antennas
- Radio Telescopes
- Radar Antennas
- "Trans-Horizon" Antennas
- Tropospheric Scatter
- Ionospheric Scatter

WARNING -- *Radar Trap!*

One way to get a ticket that can't be fixed is to try a high-speed sneak attack past the line of "Texas Tower" radar sentinels now guarding our shores.

When an intruder approaches, his range, bearing, course and speed are instantly flashed to the Continental Air Defense Command, along with voice and intercept command signals. This information, "multiplexed" by Lenkurt single-sideband carrier equipment, rides ashore on a microwave radio beam.

Lenkurt, a leading specialist in telecommunications, has worked directly with government agencies and with other manufacturers in planning and providing communications circuits for many vital defense installations. Lenkurt equipment, whether "off-the-shelf" or designed especially for the job, offers the trouble-free reliability so essential to applications involving our national security.

Lenkurt maintains facilities keyed to research, development, and precision production of carrier, microwave, and complete communications systems. Specify Lenkurt, and take advantage of the unique experience of a company geared to meet the exacting requirements of government and military applications.

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ELECTRIC

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